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EDUCATIONAL LEAFLETS

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The Mutual Life Insurance Co.



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INTRODUCTION

THE Educational Leaflets of The Mutual Life Insurance Company of New York were first issued serially, in the year 1903, and afterwards bound in a single volume. This revision of the work is published primarily for the instruction of agents of the Company just entering upon their career as solicitors. It follows that the matter presented is at first of an elementary character, and the language employed is necessarily simple and free from technical terms, save as the latter are defined with the progress of the work. The aim has been to adapt the language used to the comprehension of the beginner, who knows absolutely nothing of the subject; but the decidedly primary character of the matter treated of in the first few pages will gradually give place to more technical discussions. Every new term will be printed in italics when it first appears and will be defined at once, although fuller explanations may come later.

The work is designed to constitute a practical course of instruction in the scientific features of life insurance to the extent, at least, of including the essential elements with which the professional solicitor should be familiar. A cross index will be provided so that every definition and every discussion of any subject may be referred to readily.

Life insurance is now generally regarded as a profession, and as that view gains recognition, a preparatory course of study is gradually coming to be

TO WHAT OBJECTS?

deemed important if not essential. Several institutions have been recently established in this country for the purpose of teaching insurance by correspondence, and three or four universities have already included in their curricula a course in life insurance, while others provide frequent lectures on the subject. It is probable, therefore, that our Managers can make use of these Educational Leaflets to secure many good agents from among those just entering upon the work. Such persons have here the opportunity to secure, without expense, a thorough course of instruction in the principals of the business, while at the same time acquiring a practical knowledge of the work and making their own living by soliciting insurance under the direction of the Manager.

GEORGE T. DEXTER,
Second Vice President.

CHAPTER I

ORIGIN OF LIFE INSURANCE, ITS CHARACTER AND OBJECT

PERVADING all nature we find the fundamental principle of life insurance, *help for the helpless*. The birds of the air provide food and shelter for their nestlings. The beasts of the field minister to the wants of their helpless offspring. Both savage and civilized man yield to the promptings of this universal instinct in caring diligently for their little ones and for their dependents.

To supply the immediate needs of these is easy enough for the young and the strong, but the true man would provide also for their future necessities, when, by reason of ill health or old age, he is no longer able to care for them through his personal efforts. This, too, is a simple problem for the industrious and the thrifty. One has only to lay aside regularly and to invest safely a portion of his income to have in a few years, or at most in old age, a sufficient dependence for his family.

But suppose death were to intervene before this end has been attained. To provide for this contingency modern *Life Insurance* has been devised. In its simplest form, a number of persons combine to create a common fund to be drawn upon in providing for the families of deceased members of the organization. Every member of the organization has a voice in its management, and each has a personal interest in the accumulated funds of the society in proportion to the amount he has contributed thereto.

MUTUAL COMPANIES

Such an organization is appropriately termed a *Mutual Life Insurance Company*. The contract which is made by the company with the member, fixing the amount to be paid in the event of his death, is called a *Life Insurance Policy*, and the person to whom the amount is payable is termed the *Beneficiary*. The contract or policy also stipulates the amount which the member is to contribute to the common fund, and defines his rights and privileges in other respects. The person holding such a contract is termed the *Policy-holder*. The contribution to be made by him to the common fund as stipulated in the policy, is termed the *Premium*, and this is usually payable yearly, or in half-yearly or quarterly instalments.

The Mutual Life Insurance Company of New York is precisely such an organization as that described above. It is purely mutual, owned and controlled by the policy-holders, and is directly managed by a board of trustees who are chosen by the policy-holders. Every member of The Mutual Life, who has held a policy for one year or more, is entitled to one vote which may be forwarded by mail or cast in person or by proxy. At a recent election, when matters of special importance were under consideration, more than 300,000 policy-holders expressed their choice for trustees at the polls, nearly ninety per cent. of whom cast their votes directly by ballot, in most cases forwarded by mail.

STOCK COMPANIES

There is another class of companies known as *Stock Companies*, which are owned and controlled by

a limited number of individuals termed *Stockholders*, whose respective shares or interests are represented and defined by a written instrument termed a *Certificate of Stock*. These shares or certificates of stock may be sold or transferred at the will of the holder, and the control of the company will be changed accordingly. The stockholders of such an organization receive a portion or all of the savings or so-called "profits" of the business, and the officers who manage its affairs are chosen from their number. When the policy-holders of such a company share with the stockholders in the gains, or savings, the organization is termed a *Mixed Company*.

In The Mutual Life Insurance Company of New York there are no stockholders, and no officer or trustee has any proprietary interest in the organization or receives any perquisites or profits by reason of his position, other than a reasonable compensation for services rendered. His interest in the accumulated funds of the Company is no more and no less than that of any other policy-holder, in proportion to the insurance carried by him. In the control of the Company he has but a single vote, the same as any other policy-holder, irrespective of the number of policies or the amount of insurance carried by him.

The Mutual Life of New York is the oldest active company in America, having commenced business in February, 1843. It is also one of the strongest financial institutions in the world. As before stated, its assets are the property of the policy-holders, the interest of each being proportionate to the amount contributed by him thereto.

ELEMENTARY PRINCIPLES

Let us now consider some of the underlying principles of scientific life insurance. It is perhaps not essential to the solicitor's success that he be proficient in all the technicalities of the science, but there are some things which he must know, and he will the more readily comprehend and acquire these if he understands at least the elementary principles upon which the business rests.

To illustrate the subject we shall treat first of the life insurance contract in its commonest form, the *Ordinary Life Policy*. In the case of this contract the premium is to be paid every year during the life of the insured, the insurance amount being payable at death. Before entering into a contract of this kind it becomes necessary to fix the amount of the premium, which should be large enough to enable the company to meet the necessary expense of conducting the business and to accumulate a fund sufficient to pay the amount of the policy when the same matures by the death of the insured.

MAKING THE PREMIUM

If it were known to a certainty just how long the policy-holder would live, say, for example, twenty years, anyone could compute the amount of the necessary premium. Let us suppose, for illustration, that the face of the policy is \$1,000, that the policy-holder will live just twenty years, and, to simplify the problem, that there will be no expenses connected

with the business and no interest earned. In that event, a payment of \$50.00 a year for twenty years would amount to just \$1,000, and would be therefore the yearly premium required.

Let us assume, however, that while the business is still conducted without expense, the premiums are all to be invested at interest from date of payment. We do not know to a certainty what rate of interest can be earned during the whole period, and we shall therefore assume a rate that we can safely depend upon, say three per cent. Any schoolboy will solve the problem now, and tell us that a yearly payment of \$36.13 invested at three per cent. compound interest will amount to \$1,000 in twenty years, and that this is therefore the yearly premium required.

Observe now, that if it were certain that the policy-holder would live just twenty years, and that his premiums would earn just three per cent. interest and that the business could be conducted without expense, the necessary premium would be \$36.13. But there *will* be expenses and there are certain other contingencies that should be provided for, such, for example, as a loss of invested funds, or a failure to earn the full amount of three per cent. interest.

To meet these expenses and contingencies something should be added to the premium. Let us estimate as sufficient for this purpose the sum of \$7.00. This will make our gross yearly premium \$43.13, the original payment (\$36.13) being the *Net Premium*, while the amount added thereto for expenses, etc. (\$7.00), is termed the *Loading*.

The *Net Premium* is the amount which is mathematically necessary for the creation of a fund sufficient to enable the Company to pay the policy in full at maturity.

The *Loading* is the amount added to the net premium to provide for expenses and contingencies.

The net premium and loading combined make up the *Gross Premium*, or the total sum to be paid yearly by the insured.

THE MORTALITY TABLE

If it were known to a certainty how long any man would live, the business of life insurance would be reduced to a very simple basis—would in fact become merely a commercial transaction of saving and lending. Although it is impossible to predict in advance the length of any individual life, as in the illustration given above, there is a law governing the mortality of the race by which we may calculate the average lifetime of a large number of persons of a given age. We cannot predict in what year the particular individual will die, but we may determine with approximate accuracy how many out of a large number will die at any specified age. By means of this law it becomes possible to compute the premium necessary to be charged at any given age with almost as much exactness as in the example given, in which the length of life remaining to the individual was assumed to be just twenty years.

If you will study the mortuary records of any community and note the various ages at which the several deaths have occurred, you will find the yearly mortality governed by a law which is practically invariable. Let us suppose for example that your

observations cover a period of time sufficient to include the history of 100,000 lives. Of these you will find a certain number dying at age thirty, a higher death rate at age forty, and so on at the various ages, the extreme limit of life reached by anyone being in the neighborhood of one hundred years. The mortuary records of other communities, where conditions were practically the same, would give approximately the same results—the same number of deaths at each age in 100,000 born. The variation would not be great and the larger the number of lives under observation, the nearer the number of deaths at the several ages by the several records would approach to uniformity.

In this manner *Mortality Tables* have been constructed which show how many in any large number of persons born, or starting at a certain age, will live to age thirty, how many to age forty, how many to any other age, and likewise the number that will die at each age, with the average lifetime remaining to those still alive.

The *American Experience Table of Mortality* was constructed about the year 1861 by Sheppard Homans, the then Actuary of The Mutual Life Insurance Company of New York, and was based mainly upon the history of lives insured in that company. The table begins with 100,000 persons at age ten and fixes the *Limit of Life* at ninety-six years—the attained age at which the last three of the original 100,000 are assumed to die. The premium rates of practically all American companies are based upon this table. Fuller information regarding this and other mortality tables will be given in a later article.

In the next chapter we shall show how the necessary premium in practical life insurance is determined with the aid of the mortality table.

CHAPTER II.

THE COMPUTATION OF THE PREMIUM

WE propose now to explain the computation of the life insurance premium. This is information which, in one sense, is not essential to the success of the solicitor, since he finds his premiums ready-made in his rate book; but a knowledge of the principle involved in the computation is essential to a perfect comprehension of other matters which he must know.

We present for reference on page 13 the American Experience Table of Mortality defined in the previous chapter (page 11).

As heretofore explained the table begins with 100,000 lives, starting with the age of ten years. Of these, 81,822 will still be living at the age of thirty-five of whom 732 will die during the year. This will leave 81,090 still living at the beginning of the next year at age thirty-six, while 737 of this number will die in the ensuing twelve months. At age fifty-six there will be living 63,364 of the original number and of these, 1,260 will die during the year. In the same way the table shows how many of the original 100,000 are living at each age from ten years on, and how many will die in each year thereafter until the last three, who have lived to attain the age of ninety-five, are assumed to pass away during or at the end of that year, none living beyond the attained age of ninety-six.

A HYPOTHETICAL COMPANY

Let us suppose, now, that we have organized a life insurance company composed of 63,364 persons, each

AMERICAN EXPERIENCE TABLE OF MORTALITY.

Age	Number Living	Deaths Each Year	Death-rate Per 1,000	Expecta-tion of Life	Age	Number Living	Deaths Each Year	Death-rate Per 1,000	Expecta-tion of Life
10	100,000	749	7.49	48.72	53	66,797	1,091	16.33	18.79
11	99,251	746	7.52	48.08	54	65,706	1,148	17.40	18.09
12	98,505	748	7.54	47.45	55	64,568	1,199	18.57	17.40
13	97,762	740	7.57	46.80	56	63,364	1,260	19.88	16.72
14	97,022	737	7.60	46.16	57	62,104	1,325	21.33	16.05
15	96,285	735	7.63	45.50	58	60,779	1,394	22.94	15.39
16	95,550	732	7.66	44.85	59	59,385	1,468	24.72	14.74
17	94,818	729	7.69	44.19	60	57,917	1,546	26.69	14.10
18	94,069	727	7.73	43.53	61	56,371	1,628	28.88	13.47
19	93,302	725	7.76	42.87	62	54,743	1,718	31.29	12.86
20	92,637	723	7.80	42.20	63	53,060	1,800	33.94	12.26
21	91,914	722	7.85	41.53	64	51,290	1,889	36.87	11.67
22	91,192	721	7.91	40.85	65	49,841	1,980	40.13	11.10
23	90,471	720	7.96	40.17	66	47,661	2,070	43.71	10.54
24	89,751	719	8.01	39.49	67	45,291	2,158	47.65	10.00
25	89,032	718	8.06	38.81	68	43,188	2,248	52.00	9.47
26	88,314	718	8.13	38.12	69	40,990	2,321	56.76	8.97
27	87,596	718	8.20	37.43	70	38,569	2,391	61.99	8.48
28	86,878	718	8.26	36.73	71	36,178	2,448	67.66	8.00
29	86,160	719	8.34	36.03	72	33,730	2,487	73.73	7.55
30	85,441	720	8.43	35.33	73	31,243	2,505	80.18	7.11
31	84,721	721	8.51	34.63	74	28,738	2,501	87.08	6.68
32	84,000	723	8.61	33.92	75	26,237	2,476	94.37	6.27
33	83,277	726	8.72	33.21	76	23,761	2,431	102.31	5.88
34	82,551	729	8.83	32.50	77	21,330	2,369	111.06	5.49
35	81,822	732	8.95	31.78	78	18,961	2,291	120.83	5.11
36	81,090	737	9.09	31.07	79	16,670	2,196	131.73	4.74
37	80,358	742	9.23	30.35	80	14,474	2,091	144.47	4.39
38	79,611	749	9.41	29.62	81	12,338	1,964	158.60	4.05
39	78,863	756	9.59	28.90	82	10,419	1,816	174.30	3.71
40	78,108	765	9.79	28.18	83	8,603	1,648	191.56	3.39
41	77,341	774	10.01	27.45	84	6,955	1,470	211.36	3.08
42	76,567	785	10.25	26.72	85	5,485	1,202	235.55	2.77
43	75,782	797	10.52	26.00	86	4,198	1,114	265.68	2.47
44	74,985	812	10.83	25.27	87	3,079	938	308.02	2.18
45	74,178	828	11.16	24.54	88	2,146	744	346.69	1.91
46	73,345	848	11.56	23.81	89	1,402	555	395.36	1.66
47	72,497	870	12.00	23.08	90	847	385	454.54	1.42
48	71,627	896	12.51	22.36	91	462	246	532.47	1.19
49	70,731	927	13.11	21.63	92	216	137	634.26	.98
50	69,804	962	13.78	20.91	93	79	58	734.18	.80
51	68,842	1,001	14.54	20.20	94	21	18	857.14	.64
52	67,841	1,044	15.39	19.49	95	3	3	1000.00	.50

fifty-six years of age, and each insured for \$1,000 payable at death. We take the figures 63,364 as our total membership merely for convenience sake, that being the number of persons still living at age fifty-six as given in

the mortality table. If we can show what premium it would be necessary to collect at age fifty-six, we can by the same process determine the required premium for any other age. It is also for convenience sake—to make the problem as simple as possible—that we assume that each member of our hypothetical company will maintain his membership during his entire lifetime, and that no new members will be added after the date of organization. Withdrawals and additions have no effect upon the amount of premium which it is necessary to collect to enable the company to fulfill its contracts, all of which will be more fully explained hereafter. In the same way, although members may die at any time during the year, and the practice is to pay losses as soon as possible after death, yet, theoretically, these losses are payable at the *end* of the year, and our computations are made on that basis. The practice of paying claims before the end of the year merely involves the loss of a little interest which the companies more than make up from other sources.

We have then 63,364 persons insured, each of whom is to receive at death \$1,000. This will make a total ultimately to be paid of \$63,364,000. This enormous sum is to come entirely from the premiums that are to be paid by the original 63,364 members and the interest which those premiums will earn. The problem now is to determine how large a premium each member must pay in order to create a fund which, with the interest to be earned, will be sufficient for this purpose.

THE FIRST STEP

If we could start out on the day of organization with this fund complete—money enough in hand to pay every one of these policies in full as it matures by the

death of the member, the business would be greatly simplified. We should then have no occasion to worry regarding future withdrawals and collections, nor concerning the ability of the company to pay the last man in full, even without the influx of "new blood"—the addition of new members. This is in fact the essential principle involved in so-called "old line" life insurance—the collection of a premium large enough to maintain a fund sufficient for the ultimate payment of all existing policies without the necessity of adding new members. The first step to be taken then is to ascertain how large a *total fund* we ought to have on hand *at once* for the accomplishment of this end.

Turn now to the figures of the mortality table given above. We have 63,364 members all of whom, according to the table, will die within the next forty years. We do not know when any particular one will die, nor how long any individual member will live. The amount that each member should pay, therefore, cannot be determined by means of a computation based upon a single life, as in the example heretofore given on page 8. But if we do not know how long any one individual will live, the mortality table tells us how long certain groups of members will live. For example, we see by the table that, of the members of our company living at age fifty-six, 1,260 will live not more than one year; that 1,980 will die in the tenth year; 1,292 in the thirtieth year, etc.; and that the last three will live not to exceed forty years, to age ninety-six. We must base our computations then, upon the aggregate number of lives—the length of time the members will live as a body, as shown in the case of these several groups.

Referring to the table, for example, we see that 1,980 members will die during or at the end of the tenth year, at the attained age of sixty-six. We know therefore that we shall need \$1,980,000 at the end of the tenth year in order to pay \$1,000 for each death. We do not need that amount on hand to-day, for our funds will earn some interest during the next ten years. We require therefore, at this time, only a sum sufficient to amount to \$1,980,000 in ten years, at such rate of interest as can be earned.

THE INTEREST RATE IN LIFE INSURANCE

Here again we do not know what amount of interest will be earned. A rate of five or six per cent. or a little more, may be had in some cases, but as a rule the rate will be less and we shall also have a small amount of idle funds on hand at times. Above all, a *safe* investment is to be preferred to large earnings, and it is a rule of finance that, the higher the ratio of profit the poorer the security. It follows that in our haste to gain large earnings, the principal itself might be lost, thus defeating the purpose of our organization. That must not be. In life insurance, first of all, the funds must be safe. It would be no misfortune to have an accumulation *larger* than needed, but an *insufficient* fund would mean that widows and orphans must suffer. We must therefore assume a rate of interest such as the safest possible class of securities may be depended upon to earn, not now merely but for many years to come. On that basis The Mutual Life Insurance Company of New York assumes that its invested funds will earn on the average not less than three per

cent. That they will earn a higher rate than that for many years may be conceded as certain. If it were not certain, less might be earned, for the exact rate cannot be determined in advance.

The present worth of \$1,980,000 due in ten years is \$1,473,305.94, that being the sum which at three per cent. interest will amount to \$1,980,000 in ten years. If we have that amount on hand to-day and can safely invest it at three per cent. interest, it is mathematically certain that we shall be able to pay the death claims of the tenth year.

Turning again to the mortality table, we see that in the twenty-fifth year, at age eighty, there will be 2,091 deaths calling for the payment at the end of that year of \$2,091,000. The present worth of that sum at three per cent. is \$998,673.25. If then we have that much on hand to-day for use in the twenty-fifth year and it can be safely invested at three per cent. interest, it is mathematically certain that we shall be able again to pay the death claims of that year.

Or take the 1,260 deaths of the first year. These claims, payable at the end of the year, call for the sum of \$1,260,000 and the present worth of that amount due in one year is \$1,223,300.98.

Is it not clear that we can in like manner determine from the mortality table what our losses will be for each year, even to the last or fortieth year, when the death claims will amount to \$3,000? And can we not thus find the present worth of the amounts which will be needed in each and every year to pay all the claims of such years until the last three members pass away in the

fortieth year of their membership, at the attained age of ninety-six? Nine hundred and nineteen dollars and sixty-seven cents on hand to-day will amount in forty years, at three per cent. interest, to \$3,000, or sufficient to pay in full the policies of the last three members of our company.

THE TOTAL INSURANCE FUND

In the following table, we have arranged in columns the death claims of the first, tenth, twenty-fifth and fortieth years as given above:

Age Begin- ning of Year	Year	Attained Age End of Year	Death Claims	Present Worth of Claims
56	First year	57	\$1,260,000	\$1,223,300.98
*	*	*	*	*
65	Tenth year	66	1,980,000	1,473,305.94
*	*	*	*	*
80	Twenty-fifth year	81	2,091,000	998,673.25
*	*	*	*	*
95	Fortieth year	96	3,000	919.67
Totals.....			\$63,364,000	\$39,360,583.39

The stars take the place of the other years as given in the complete mortality table for the several ages from fifty-six on, the figures for which may be determined in the same manner.

You may work it out for yourself. Note the number of deaths in each year according to the mortality table until the last three members die. Find the present worth of the amount required in each year for payment

of claims, and place in the column headed present worth. Find the total of these present worths, and you will get the sum of \$39,360,583.39.

With this amount on hand to-day, on the assumption that the same will earn three per cent. interest, we shall have funds sufficient for the payment of every death claim that can possibly occur, according to the mortality table, in any year until the last three members die, in the ninety-sixth year of their age. That sum divided by 63,364, the number originally insured in our hypothetical company, gives \$621.18... In other words, if each member of our Company will pay in cash the sum of \$621.18..., we shall have at date of organization a total of \$39,360,583.39, or sufficient to pay every existing policy in full as the several deaths occur. This \$621.18 is termed the *Net Single Premium*, and is the *net* amount, without provision for expenses, which a man at age fifty-six should pay for a full paid policy of \$1,000.

The net single premium having been deposited, no further payments would ever be required, but most men would find it inconvenient to pay for their life insurance in a single sum. By means, however, of an equally simple mathematical process we may apportion that net single premium into equivalent *yearly* payments to be made by the insured during life. Before entering into an explanation of that process, it becomes necessary to explain the meaning of several new terms which will be taken up in the next chapter,

CHAPTER III

THE LIFE ANNUITY

IT is our purpose to show now how the net single premium may be apportioned into small yearly payments, to be made during life, which shall be the exact mathematical equivalent of the former. To understand the process, one must know something of annuities.

An *Annuity* is a specific sum of money to be paid yearly to some designated person. The one to whom the money is to be paid is termed the *Annuitant*. If the payment is to be made every year until the annuitant dies, it is termed a *Life Annuity*. For example, a life insurance company or other financial institution, in consideration of the payment to it of a specified amount, say \$1,000, will enter into a contract to pay a designated annuitant a stated sum, say \$100, on a specified day in every year so long as the annuitant continues to live. The latter may live to draw his annuity for many years, until he has received in the aggregate several times the original amount paid by him, or he may die after having collected but a single payment, or even earlier. In either case the contract expires and the annuity terminates with the death of the annuitant.

The amount of yearly income or annuity which can be purchased with \$1,000 will depend of course upon the age of the annuitant. That sum will buy a larger income for a man of seventy than for one of fifty-six, for the reason that the former has, on the average, a much shorter time yet to live. The net cost of an

annuity, that is, the net amount to be paid therefor in one sum, and which is termed the *Value of the Annuity*, is not a matter of estimate but, like the life insurance premium, is determined by mathematical computation, based upon the mortality table. The process is quite as simple as the computation of the single premium, and exactly similar.

COMPUTING THE VALUE OF THE ANNUITY

Let us undertake, for example, to determine the net amount which a company should charge in a single sum for a life annuity of \$1.00 to be paid to every one of 63,364 persons, all of the age of fifty-six years, the first payment to be made immediately on the execution of the contract. The figures named will be recognized as the number of persons still living at age fifty-six out of 100,000 starting at age ten, as given in the American Experience Table of Mortality, page 13, and already adopted in our hypothetical life insurance company.

As each person is to receive \$1.00 immediately, it is obvious that the company will require a sum in hand of \$63,364.00 in order to pay the annuities due at the beginning of the first year, on the execution of the contract.

It will also be seen by the table that 1,260 annuitants will die during the first year after having received but one payment. Nothing more is to be paid on their account. This leaves 62,104 persons still living on the

first day of the second year, each of whom is to receive a payment of \$1.00 on that day. The company will require therefore to have on hand at the beginning of the second year a total of \$62,104.00 to pay the annuities then due. The present worth of that sum at three per cent. is \$60,295.15, which represents, therefore, the amount that it should have in its possession to-day to enable it to pay the annuities due one year hence.

Turning to the table again we find 49,341 persons still living at the beginning of the tenth year at age sixty-five and each of these is to receive \$1.00, requiring a total payment on that day of \$49,341.00. The present worth of that sum at three per cent. interest due in nine years is \$37,815.77, which represents the amount the company must have on hand to-day to enable it to pay the annuities due at the beginning of the tenth year.

There will be three persons living on the first day of the fortieth year at age ninety-five, requiring the payment on that day of \$3.00, the present worth of which sum payable thirty-nine years hence is \$0.947, or ninety-five cents.

It is not necessary to illustrate further the process by which we determine the present worth of the several amounts to be paid out in annuities to those living at the beginning of each year until the last three of the original 63,364 pass away in the fortieth year. As in the computation of the single premium, we have arranged in columns in the following table the several amounts to be paid out in annuities at the beginning of the first, the second, the tenth and the fortieth years and the present worth of those sums as given above.

Age Begin- ning of Year	Year	Number Living	Annuities to be paid	Present Worth of Annuities
56	First year	63,364	\$63,364	\$63,364.00
57 *	Second * year	62,104 *	62,104 *	60,295.15 *
65 *	Tenth * year	49,341 *	49,341 *	37,815.77 *
95	Fortieth year	3	3	0.95
		Totals.....	\$1,091,123	\$824,117.31

The stars represent the figures for the ages omitted. If these omissions be correctly supplied, the total of all the present worths will be as given, \$824,117.31. But \$824,117.31 divided by 63,364 gives just \$13.006..., or thirteen dollars and one cent. If, therefore, each one of our original 63,364 persons at age fifty-six will contribute the sum of \$13.006...toward the creation of an annuity fund, we shall have a total of \$824,117.31, or just enough to pay each man an annuity of one dollar at the beginning of each year so long as he lives, provided that the deaths occur as indicated by the mortality table, and that our funds earn three per cent. interest.

TO FIND THE NET ANNUAL PREMIUM

The value, or cost, of a life annuity of \$1.00 at age fifty-six by the American Experience Table and three per cent. interest, is thus found to be \$13.006. In other words, \$13.006 paid down in one sum is the exact mathematical equivalent at age fifty-six of the

payment of \$1.00 at the beginning of each year during life. We have seen that the net single premium for \$1,000 life insurance at age fifty-six is \$621.18. If \$13.006 is the mathematical equivalent of \$1.00 to be paid annually during life, \$621.18 must be the mathematical equivalent of as many dollars to be paid yearly during life, as \$13.006 is contained times in \$621.18. Performing the division we get \$47.76. In other words, \$47.76 paid at the beginning of each year during life is the exact equivalent of the net single premium of \$621.18, and is therefore the net annual premium of an ordinary life policy of \$1,000 at age fifty-six, according to the American Experience Table and three per cent. interest.

GENERAL OBSERVATIONS

We have seen that at age fifty-six the sum of \$13.006 will purchase a life annuity of \$1.00; in other words, \$13.006 paid in one sum is the mathematical equivalent of \$1.00 to be paid at the beginning of every year during life.

We have also seen that \$621.18 paid in one sum is the mathematical equivalent of \$47.76 paid yearly during life.

These equivalents may be expressed in the following proportion:

$$\$13.006 : \$1.00 :: \$621.18 : \$47.76$$

That is, the *value of a life annuity of \$1.00*, is to \$1.00, as the net single premium at the same age is to the equivalent net annual premium.

Observe that the value of a life annuity of \$47.76 at age 56 would be \$621.18; that is to say the net single premium of an ordinary life policy will purchase a life annuity equal in amount to the net annual premium of the same policy.

In all these observations we speak of *net* premiums only, the matter of loading for expenses remaining to be adjusted.

SUFFICIENCY OF THE PREMIUM

If you have read the preceding pages with care you have now some comprehension of the scientific basis of life insurance. You now know for yourself that it is possible to determine in advance the cost of insuring a given number of lives. You know for yourself that the premium, mathematically computed in the manner set forth, is sufficient for the payment of all claims that can ever occur until the last policy has matured by the death of the insured.

There can be no uncertainty as to the adequacy of the premium so computed. There may, indeed, be uncertainty as to the rate of interest to be received, but only in respect of what the excess may be. We may easily earn *more* than the rate assumed, but that rate is so low that it is morally certain that, through a series of years, we shall not average less. It is therefore certain that, while the premium may be *larger* than necessary by reason of the increased interest earnings, it cannot be smaller than is requisite. The mortality, likewise, may prove to be less than indicated by the table, but the universal experience of well-managed companies has

demonstrated that, through a series of years, it will not average more than the tabular rate. This again means that, by reason of a low mortality, our premium may prove larger than necessary, but it will not be smaller than required.

It is better that the premium should be too large than too small. To have on hand more funds than may, perchance, be needed for the payment of death claims is not a serious misfortune; since the excess can be returned to the policy-holders subsequently. To have less than sufficient for the payment of claims would mean insolvency and dissolution.

EFFECT OF WITHDRAWALS

In our hypothetical company it was assumed that all members would continue to pay their premiums until death. In practice it is well known that many withdraw after having made one or more payments. The member who drops out, thereby forfeiting the payments he has already made, is said to *Lapse*. The question arises, what allowance should be made in the computation of the premium for the gains that may accrue from lapses? We shall answer this question only briefly and partially now, but more fully in a later chapter.

That there will be lapses is certain, but it does not follow that there will be a real gain from that source. Experience has shown that it is the sound life as a rule that withdraws. After a company has been in existence for some years many of the members are in impaired health. These are not likely to lapse. The man who is

about to die will cling to his insurance. The man who is in robust health is the one to withdraw. It is conceivable that lapses might multiply until presently we should have merely a company of invalids with a mortality in excess of any known table. In other words, the apparent gain from lapses is apt to be offset by an increased mortality.

It is impossible to determine in advance what the lapse rate of any company will be, or what will be the relative proportions of invalids and sound lives among the withdrawing members. It is impossible, therefore, to determine beforehand what allowance, if any, should be made on account of the possible profits accruing from that source. Accordingly, it is assumed in the computation of the premium that there will be no lapses and hence no gains therefrom. If, as a matter of subsequent experience, there prove to be such gains, then, as in the case of excess interest and savings in mortality, the surplus thus accruing will be apportioned equitably among the members, after it is known that there has been a gain from that source.

Notwithstanding the fact that the impaired risk is not apt to lapse his policy, there are indications that the mortality among withdrawals in after-life is as great as among the body of persistent members, for the reason that many of those that withdraw under normal conditions are of the shiftless, vacillating class who are less likely to live to old age than the thrifty, determined class. However this may be, nothing is more clearly demonstrated than that when lapses are excessive, as when

the policy-holders have lost confidence in the company or its management, the sound lives who can secure insurance elsewhere withdraw in much larger proportion than under ordinary conditions. This is clearly shown by the excessive mortality in companies which have suffered from heavy withdrawals due to lack of confidence in the management or in the plan of insurance, as shown by the abnormal mortality in decadent assessment companies.

EFFECT OF NEW MEMBERS

Another question naturally arising is, would not the addition of new members reduce the cost of insurance and render it practicable to charge a small net premium? As in the case of the preceding topic, we have space to answer only briefly now, but will explain more fully in a later chapter.

We assumed that there would be no new members, chiefly to simplify the matter of computation, but it is also true that each age must bear its own natural cost, that the addition of new members is not essential to the successful career of a well-established company, and that such additions cannot affect the amount of premium mathematically necessary.

Turn again to the mortality table. Notice that at age fifty there are 69,804 of the original 100,000 persons still living. Assume, now, the organization of another company of 69,804 members all fifty years of age, and, by the method of computation heretofore illustrated you will find the net annual premium at that

age to be \$36.36. This is the net amount mathematically necessary for each member entering such a company at age 50 to pay yearly during life to enable the company to pay all policies as they mature by death.

Can the net annual premium of \$47.76 charged by our hypothetical company for members fifty-six years of age be reduced by the addition of "new blood"—the influx of younger men, say for example, the addition to our original company of 69,804 new members, all fifty years of age? We have seen that the net annual premium mathematically necessary at age fifty is \$36.36. If the payments of these younger men are to be applied in part to reducing the cost of the insurance to the older members, there will certainly be a deficit in their own funds unless their own premium of \$36.36 is correspondingly increased. But to make such an increase would not be equity. To charge one set of members more than mathematical cost in order to furnish another class with insurance at less than cost would be monstrous. All schemes of life insurance based upon that idea—the assessment plan—have ended or must inevitably end in failure.

CHAPTER IV

THE DIFFERENT KINDS OF POLICIES

ORDINARY LIFE AND LIMITED PAYMENT LIFE CONTRACTS

So far we have treated only of the ordinary life policy, a contract payable at death, with equal annual premiums to be paid during the lifetime of the insured. It is, however, often desirable to complete the payment of all premiums within a limited period, say within ten or fifteen or twenty years. A policy payable only at death but which is fully paid for in a limited number of premiums is termed a *Limited-Payment Life Policy*. Thus, when but ten premiums are to be paid, we have a *Ten-Payment Life*. If twenty premiums are called for, the contract is a *Twenty-Payment Life*, etc.

If the reader has not thoroughly mastered Chapters II and III, he will do well to study them again with care before going further. The net single premium of a life policy issued at age fifty-six has been shown in Chapter II to be \$621.18. Dividing this amount by the value of a life annuity of \$1.00 issued at the same age, we obtain the net yearly premium payable during life. To apportion the net single premium into a *limited* number of equivalent payments, as for example, ten, or twenty, is an equally simple process, the divisor in the case being the value of a temporary annuity running for a like period of 10 or 20 years instead of by the value of a life annuity.

DETERMINING THE LIMITED PAYMENT PREMIUM

A *Temporary Annuity* is one which, like a life annuity, terminates on the death of the annuitant, but which, unlike the latter, must terminate also when a specified number of payments have been received, as ten or twenty, even though the annuitant be still living. To determine the net yearly premium of a ten-payment life, divide the net single premium of a life policy by the value of a temporary annuity of \$1.00 terminating in ten years. The net yearly premium of a twenty-payment life is likewise found by dividing the net single premium of a life policy by the value of a twenty year temporary annuity.

COMPUTATION OF TEMPORARY ANNUITY

The value of a temporary annuity is computed by a process similar to that followed in the case of a life annuity. Assume, for example, that every member of our hypothetical company (page 12), is to receive a temporary annuity of \$1.00 at the beginning of every year for ten years. Turn now to the illustration on page 23. The present worth of the amount required to make an immediate payment of \$1.00 to each of 63,364 persons would be \$63,364. The present worth of the amount required to pay the annuities of the second year at age fifty-seven would be \$60,295.15. The present worth of the amount required for the tenth year at age sixty-five would be \$37,815.77. The student will readily calculate the present worth of the amounts required to pay the annuities of each of the intervening years. The sum of

all these present worths from the first year to the tenth inclusive, will be the total present fund required to enable the company to pay the annuities of the entire ten years. Dividing this sum by the original number of annuitants, to wit: 68,364, will give us the value of a temporary annuity of \$1.00, granted at age fifty-six, and terminating with the tenth payment. The value of a twenty-year temporary annuity of \$1.00 may be ascertained in the same manner.

TERM INSURANCE

Men sometimes desire temporary life insurance for the sake of protection during a specified period pending the development of a business enterprise, the maturity of a debt, the dependence of minor children, etc. Suppose, for example, that the insurance is taken for ten years instead of for the whole of life. If the insured dies within the period named his policy will be paid. If he lives longer than ten years, the insurance terminates—the contract is of no further validity.

This is called *Term Insurance*. A *Term Policy* is one which is payable only at death and then only on condition that death occurs within a stated period—the term for which the contract is written. A contract covering a period of ten years is a *Ten-Year Term Policy*. In the same way we have a *One-Year Term*, a *Twenty-Year Term*, a *Thirty-Year Term*, etc.

Such a policy is sometimes renewable for one or more periods at a correspondingly higher rate, but without regard to the physical condition of the insured.

This is *Renewable Term Insurance*, and we have accordingly a *Yearly Renewable Term*, a *Ten-Year Renewable Term*, etc. A renewable term policy may, nevertheless, by stipulation in the contract finally terminate at a fixed date. For example, we may have a ten-year renewable term "terminating at age seventy." Term insurance in The Mutual Life is not renewable save in the case of the "yearly renewable term", which expires at age 65 but may then be changed to ordinary life with premium corresponding to attained age.

The discontinuance of a term policy at the completion of the period for which it was written is called a *Termination by Expiry*.

DETERMINING THE PREMIUM OF A TERM POLICY

The process of computing the premium of a term policy will be readily understood. Let us assume, for example, that the members of our hypothetical company (page 12), are all insured for a term of only ten years instead of for the whole of life. With 68,364 persons insured at age fifty-six, we shall have the death claims of the first ten years only to pay. The 47,361 persons living beyond that period, although they have paid premiums for ten years, will receive nothing. Turning to page 18, we note that the present worth of the amount required to pay the losses of the first year is \$1,223,300.98. In like manner the present worth of the amount required for the tenth year is \$1,473,305.94. From explanations heretofore given, the reader will be able to compute the present worth of the several amounts required for the

intervening years. The sum of the present worths of the first ten years will be the total insurance fund necessary to have on hand at the beginning to enable the company to pay all the losses of ten years, and this amount divided by the whole number of insured lives, to wit: 63,364, will give us the net single premium of a ten-year term policy at age fifty-six by the American Experience Table and three per cent. interest. Dividing the net single premium by the value of a ten-year temporary annuity of \$1.00 (see page 31), will give us the net annual premium required

SO-CALLED "PROFITS" IN LIFE INSURANCE

The holder of a term policy who lives beyond the end of the period for which the contract was written, has paid simply for protection during that period. There is nothing more coming to him for the premiums he has expended, yet he is neither gainer nor loser by the transaction. He has received the protection for which he paid, and has had it at exact cost.

The company which pays a loss of \$1,000 in the first year, having received from the deceased but one yearly premium of possibly \$39.26, is neither gainer nor loser by the transaction. It insures 63,364 persons for a period of ten years, and during those ten years it collects from the insured members the exact amount of money necessary for the payment of all losses, according to its computation based upon the mortality table and the assumed rate of interest, plus the necessary loading for

expenses. It is immaterial to the company whether this member or that member lives or dies; the total death claims cannot exceed a certain amount, and for the payment of those claims the company has collected the exact mathematical cost.

All this is equally true of the ordinary life policy, the limited payment policy, and of every other form of contract written, all alike being based upon exact mathematical cost. In life insurance there can be neither gain nor loss, to company or policy-holder, so long as the mortality corresponds with that of the table, the interest received with the assumed rate, and the expense of management and outlay for contingencies with the provision made therefor in the loading.

In practice, however, there are gains in the case of every well-managed company. If, by reason of a careful selection of insured lives, the mortality is less than that indicated by the table upon which the premiums were based, the difference will be so much gain. Our hypothetical company anticipated 16,003 deaths in the course of its first ten years, as indicated by the mortality table, and accordingly made provision in its premium charge for the payment of \$16,003,000 in claims during that time. Had its actual mortality proved to be but seventy-five per cent. of that amount there would have been a considerable gain in the saving thus effected. Such gains are not uncommon in practice. Most companies have an average mortality of not more than eighty or ninety per cent. of that shown by the table. A well-managed company will likewise make gains from interest received in excess of the assumed rate, and from

the saving effected by incurring smaller expenses than the amount collected for that purpose—all of which will be treated of in a later chapter.

TO WHOM THE PROFITS GO

Bear in mind that in the case of a stock life insurance company (see page 6) the gains and savings thus effected all belong to the stockholders. In the case of a mixed company—that is, a stock company doing business on the mutual plan (page 7), a part of the savings go to the stockholders and the balance to the policy-holders. In a purely mutual organization, such as The Mutual Life Insurance Company of New York in which there are no stockholders, every dollar gained from first to last belongs to the policy-holders and will be returned to them when the apportionment of surplus is made in accordance with their several contracts. This subject will be more thoroughly discussed in a later article under the head of Surplus.

ENDOWMENT POLICIES

A man may wish to make some provision for his own future in addition to providing for his dependents. To this end *Endowment Insurance* has been devised. The *Endowment Policy* is one which is payable to the insured himself if he lives through a specified number of years or to a stated age, but payable to his legal representatives or beneficiary in the event of his prior death. Thus a policy payable to the insured himself if living at the end of twenty years, but to his beneficiary in case of

his prior death, is a *Twenty-Year Endowment*. In like manner we have a *Fifteen-Year Endowment*, a *Thirty-Year Endowment*, etc.

Such a policy is a combination of term insurance and what is known as *Pure Endowment*. The latter form of policy is payable only to those who live to complete the endowment period. Those who die prior to that date receive nothing. This is purely "investment insurance."

Assume, for example, the issue of a ten-year *Pure Endowment* for \$1,000 to each of the 63,364 members of our hypothetical company at age fifty-six. During the next ten years 16,003 members will die. These receive nothing. There will be 47,361 survivors who are to receive \$1,000 each, requiring a total payment of \$47,361,000. The present worth of that sum at three per cent., to wit: \$35,241,031.67, represents the total insurance fund required at the beginning. This amount divided by the total number insured, 63,364, gives \$556.17, the net single premium of a ten-year pure endowment at age fifty-six by the American Experience Table and three per cent. interest. That is to say, if 63,364 persons at age fifty-six contribute each the sum of \$556.17, the fund will be just sufficient, with the aid of three per cent. interest, to pay \$1,000 to each of the 47,361 members who survive the period.

THE ENDOWMENT PREMIUM

Keep in mind the fact that the holder of a pure endowment policy, who dies before completion of the endowment period, receives nothing. If, however, each

of our 63,364 members carries also term insurance covering the same period, then each one of the 16,003 who die will likewise receive his \$1,000. Thus by combining the premium of a term policy with that of a pure endowment, we obtain the premium of the regular endowment, which provides for both those who die and those who live. This may be illustrated as follows: The net single premium for a ten-year term policy of \$1,000 at age fifty-six is \$212.80, while the corresponding net single premium for a pure endowment, as already shown, is \$556.17. The former provides for all who die within the ten years; the latter for all who are still living at the end of that time. Combining the two we get \$768.97, which is the net single premium of a regular ten-year endowment.

Reverting again to the pure endowment, written as a separate contract; observe that the net single premium of \$556.17 at three per cent. compound interest, will amount in ten years to only \$747.44 instead of to \$1,000. The difference is made up by the premiums forfeited by the 16,003 members who die during the term and receive nothing.

EFFECT OF MORTALITY IN ENDOWMENT INSURANCE

The pure endowment net single premium of \$556.17 is based upon the expectation that the mortality will be the same as that indicated by the table. If there were no deaths at all during the ten years, entitling every one of our 63,364 members to an endowment of \$1,000 at the end of the period, the net single

premium for each one to pay would be \$744.09, that being the sum which at three per cent. compound interest would amount to \$1,000 in that time. That is, if there were no deaths at all during the ten years, a net single premium of only \$556.17 would leave a large deficit. Likewise, it is obvious that if there were fewer deaths than indicated by the table, there would be more endowments to pay than were counted upon, and again there would be a deficit. On the other hand, if the deaths were to exceed the mortality table, there would be fewer endowments to pay than were anticipated, and this would result in a corresponding gain. In other words, in pure endowment insurance, the higher the mortality rate, the larger the gains to the company, while a mortality less than that of the table must result in actual loss. The reverse of this is found in term insurance, where the lower the mortality, the better for the company. By combining the two forms, the favorable effect of a low mortality in term insurance more than counteracts the adverse effect of the same condition in pure endowment.

CHAPTER V

PROVING THE ADEQUACY OF THE NET PREMIUM

IF the reader has studied Chapters II and III with care, he is convinced of the correctness of the process by which the net yearly premium at age fifty-six is computed, and will readily comprehend that by a like process the necessary net premium at any other age may be ascertained. At the same time, a mathematical verification of the work may serve to fix the principle involved more firmly in his mind, and to emphasize more forcibly the certainty of the life insurance proposition.

For example, by mathematical computation we have found the net annual premium of an ordinary life policy of \$1,000 at age fifty-six, American Experience Table and three per cent. interest, to be \$47.76. Referring again to our hypothetical company, page 12, we may prove the exact sufficiency of that premium by "working it out," computing the amount of premiums received the first year, adding interest assumed, deducting claims paid, adding balance to premium income of the second year, improving the sum at interest, deducting claims, etc., until the premiums of the last three members have been collected in the fortieth year, and their policies paid.

It should be explained here that inasmuch as computations in life insurance, as in other sciences, involve the use of decimals, exact results are not attainable. For example, we have had occasion on page 17 to find the present worth of \$1,980,000, due in ten years, at

three per cent. interest. Now the present worth of \$1.00 on the terms named would be \$0.74, or, carrying it to three decimal places, \$0.744; that is, seventy-four cents and four mills. Carried to five decimals we should have \$0.74409; six places, \$0.744094. If we regard the present worth of \$1.00 as \$0.74, then the present worth of \$10.00 would be \$7.40; but if we use three decimals (\$0.744), we get \$7.44 as the present worth of \$10.00 instead of \$7.40. Again if the present worth of \$1.00 is \$0.744 the present worth of \$1,000 would be \$744.00; but if we use five decimals in the present value of \$1.00 (to wit \$0.74409) we shall have \$744.09 as the present worth of \$1,000 instead of \$744.00. It will be readily seen that the assumed present worth of a large sum like \$1,980,000 will vary materially according to the number of decimal places employed in the computation. Three decimals in the present worth of \$1.00 (to wit \$0.744) would give us \$1,473,120.00 as the present worth of \$1,980,000, while six decimals (\$0.744094) would give us \$1,473,306.12, and the still larger number of decimals employed in our computation gave us \$1,473,305.94 as a more nearly accurate result. It will be seen that in computations involving vast amounts, the greater the number of decimal places used the nearer will be the approach to actual accuracy. In compiling the Verification Table appearing in this chapter more decimal places were employed than is usual in ordinary work because of the great number of dependent computations involved. This explanation is made for the benefit of anyone who may find difficulty in verifying exactly the figures given herein.

THE EXACT NET PREMIUM

The net premium of \$47.76 given above is the amount actually collected in practice, though a more nearly correct premium, carried to six decimal places, would be a fraction of a cent more than that, to wit: \$47.760895.

The proposition now is to prove that this net premium of \$47.760895 is a sufficient charge for an ordinary life policy of \$1,000 at age fifty-six. If this can be shown it will be conceded that by the same process the adequacy of the net premium charge at other ages can be proved. In practice it is not possible to collect the fractional part of the cent (\$.000895), less than one-tenth, as we have assumed to do in the Verification Table, but the slight deficit resulting therefrom in large transactions is easily adjusted with gains from other sources.

It might be well to repeat here that the gross premium in life insurance is composed of two parts, the net premium and the loading. The net premium, with which alone we have to do at present, is devoted solely to the payment of policy claims. No part of it can be used for any other purpose. The loading is an amount arbitrarily added to the net premium for payment of expenses not otherwise provided for, and for other contingencies, and does not affect the question of the mathematical sufficiency of the *net* premium.

We have already stated, page 14, that, while in practice death claims may be paid at any time, yet, theoretically, they are all payable at the end of the year. It is upon this basis that the net premium is computed, and to prove the correctness of the computation, there-

fore, the same hypothesis must be adopted,—that all death claims are payable at the end of the year.

Our hypothetical company has 68,364 members as stated. Collecting from each of these the sum of \$47.760895, gives us a net premium income for the first year of \$3,026,821.35. To this we add twelve months' interest at three per cent. (\$90,789.64), which makes our total income \$3,117,110.99. By turning to the mortality table (page 18), we note that at age fifty-six we shall have 1,260 deaths during the year, calling for the payment of claims to the amount of \$1,260,000. Deducting these death claims from the total income, we get a balance of \$1,857,110.99. The operations of the year may be tabulated in the following manner:

Net premium income beginning of the year	\$3,026,821.35
Add one year's interest (three per cent.)	90,789.64
Total income first year.....	\$3,117,110.99
Deduct death claims.....	1,260,000.00
Balance end of first policy year	\$1,857,110.99

THE RESERVE

Study the above figures. Note that the net premium income, increased by one year's interest thereon at the assumed rate (three per cent.), constitutes our total insurance fund. This might be termed the *Mortality Fund*, but the expression has not obtained in regular life insurance, the term *Reserve* being in universal use. The *Reserve* includes all funds in life insurance devoted to the payment of policy claims—that is, the net premium

receipts and the interest earned on those receipts to the extent of the assumed rate (three per cent.). The balance of the insurance fund on hand at the end of the policy year, after deducting policy claims, is, for the sake of distinction, called the *Terminal Reserve*; while the fund on hand at the beginning of the year (consisting in the first year of the net premium income only), is termed the *Initial Reserve*.

If the terminal reserve in the above case (\$1,857,110.99) be divided by 62,104, the number of members still living (see page 60), we shall obtain \$29.90, which is the terminal reserve pertaining to each policy still in force at the end of the first year.

At the commencement of the second policy year we have 62,104 persons living at the attained age of fifty-seven years. Each of these pays the same net premium as before, making our total premium income at the beginning of the second year, \$2,966,142.62. Adding to this the amount reserved from the preceding year (\$1,857,110.99, see table of operations first year, page 43), we now have an insurance fund of \$4,823,253.61, which is the initial reserve of the second year. Again we add to this sum one year's interest at three per cent., to wit: \$144,697.61, and we get a total fund for the second year of \$4,967,951.22. Deducting from this the death claims of the year according to the mortality table, to wit: \$1,325,000, we have a balance of \$3,642,951.22, which is the terminal reserve at the end of the second policy year. If this amount be divided by 60,779, the number of members still living, we shall get \$59.94, which is the terminal reserve pertaining to

each policy at the end of the second year. The operations of the year may be tabulated in the following manner:

Net premium income second year	\$2,966,142.62
Add terminal reserve of preceding year	<u>1,857,110.99</u>
Total beginning second year (initial reserve)	\$4,823,253.61
Add one year's interest (three per cent.)	<u>144,697.61</u>
Total end of second year....	\$4,967,951.22
Deduct death claims	<u>1,325,000.00</u>
Balance end of second year, (terminal reserve)	\$3,642,951.22

A VERIFICATION TABLE

The complete solution of the problem—the proof of the sufficiency of the net yearly premium is illustrated in the annexed figures which, for convenience of reference, we have termed a Verification Table. Column four gives the net premium income for each year. Column five shows the initial reserve, consisting (after the first year), of the net premium income plus the terminal reserve of the preceding year. To the sum of these is to be added one year's interest which is set out in column six. From this amount (not entered in the table for lack of room) will be deducted the death claims of the year as indicated by the mortality table and shown in column seven. The balance (column eight), will be the terminal reserve for the year. This divided by the number of members still living (see column two, next higher age), will give the terminal reserve pertaining to each policy, as shown in column nine.

VERIFICATION

Ordinary Life, \$1,000

Age 56

Net Year

1 Age	2 Members Living	3 Deaths	4 Net Premium Income	5 Initial Reserve
56	63,364	1,260	\$3,026,321 35	\$3,026,321 35
57	62,104	1,325	2,966,142 62	4,823,253 61
58	60,779	1,394	2,902,859 44	6,545,810 66
59	59,385	1,468	2,836,280 75	8,184,465 73
60	57,917	1,546	2,766,167 76	9,728,167 46
61	56,371	1,628	2,692,329 41	11,166,341 89
62	54,743	1,713	2,614,574 67	12,487,906 82
63	53,030	1,800	2,532,760 28	13,682,304 28
64	51,230	1,889	2,446,790 65	14,739,564 06
65	49,341	1,980	2,356,570 32	15,649,321 30
66	47,361	2,070	2,262,003 75	16,400,804 69
67	45,291	2,158	2,163,138 70	16,985,967 53
68	43,133	2,243	2,060,070 68	17,397,617 24
69	40,890	2,321	1,952,943 00	17,629,488 76
70	38,569	2,391	1,842,089 96	17,679,463 38
71	36,178	2,448	1,727,894 16	17,546,741 44
72	33,730	2,487	1,610,975 50	17,236,119 18
73	31,243	2,505	1,492,194 14	16,758,396 90
74	28,738	2,501	1,372,553 11	16,128,701 92
75	26,237	2,476	1,253,103 10	15,364,666 08
76	23,761	2,431	1,134,847 14	14,484,453 20
77	21,330	2,369	1,018,740 39	13,506,727 19
78	18,961	2,291	905,595 84	12,448,524 85
79	16,670	2,196	796,174 87	11,327,155 47
80	14,474	2,091	691,291 19	10,162,261 32
81	12,383	1,964	591,423 16	8,967,552 32
82	10,419	1,816	497,620 77	7,770,199 66
83	8,603	1,648	410,886 98	6,598,192 63
84	6,955	1,470	332,177 02	5,480,315 43
85	5,485	1,292	261,968 51	4,436,693 40
86	4,193	1,114	200,261 43	3,478,055 63
87	3,079	933	147,055 80	2,615,453 10
88	2,146	744	102,494 88	1,863,411 57
89	1,402	553	66,960 77	1,242,274 69
90	847	385	40,453 48	764,996 41
91	462	246	22,065 53	425,011 83
92	216	137	10,316 35	202,078 54
93	79	58	3,773 11	74,914 01
94	21	18	1,002 98	20,164 41
95	3	3	143 28	2,912 62

TABLE

Premium \$47.760895

American Experience 3 Per Cent

6 Add One Year's Interest	7 Deduct Death Claims	8 Balance, Terminal Reserve	9 Reserve on each Policy	10 End of
\$90,789 64	\$1,260,000	\$1,857,110 99	\$29 90	1 Yr.
144,697 61	1,325,000	3,642,951 22	59 94	2 Yrs.
196,374 32	1,394,000	5,348,184 98	90 06	3 "
245,533 97	1,468,000	6,961,999 70	120 21	4 "
291,845 02	1,546,000	8,474,012 48	150 33	5 "
334,990 26	1,628,000	9,873,332 15	180 36	6 "
374,637 20	1,713,000	11,149,544 02	210 25	7 "
410,469 13	1,800,000	12,292,773 41	239 95	8 "
442,186 92	1,889,000	13,292,750 98	269 41	9 "
469,479 64	1,980,000	14,138,800 94	298 53	10 "
492,024 14	2,070,000	14,822,828 83	327 28	11 "
509,579 03	2,158,000	15,337,546 56	355 59	12 "
521,928 52	2,243,000	15,876,545 76	383 38	13 "
528,884 66	2,321,000	15,837,373 42	410 62	14 "
530,383 90	2,391,000	15,818,847 28	437 25	15 "
526,402 24	2,448,000	15,625,143 68	463 24	16 "
517,083 58	2,487,000	15,266,202 76	488 63	17 "
502,751 91	2,505,000	14,756,148 81	513 47	18 "
483,861 06	2,501,000	14,111,562 98	537 85	19 "
460,939 98	2,476,000	13,349,606 06	561 83	20 "
434,533 60	2,431,000	12,487,986 80	585 47	21 "
405,201 82	2,369,000	11,542,929 01	608 77	22 "
373,455 75	2,291,000	10,530,980 60	631 73	23 "
339,814 66	2,196,000	9,470,970 13	654 34	24 "
304,867 84	2,091,000	8,376,129 16	676 42	25 "
269,026 57	1,964,000	7,272,578 89	698 01	26 "
233,105 99	1,816,000	6,187,305 65	719 20	27 "
197,945 78	1,648,000	5,148,138 41	740 21	28 "
164,409 46	1,470,000	4,174,724 89	761 12	29 "
133,100 80	1,292,000	3,277,794 20	781 73	30 "
104,341 67	1,114,000	2,468,397 30	801 69	31 "
78,463 59	933,000	1,760,916 69	820 56	32 "
55,902 35	744,000	1,175,313 92	838 31	33 "
37,268 24	555,000	724,542 93	855 42	34 "
22,949 89	385,000	402,946 30	872 18	35 "
12,750 36	246,000	191,762 19	887 79	36 "
6,062 36	137,000	71,140 90	900 52	37 "
2,247 42	58,000	19,161 43	912 45	38 "
604 93	18,000	2,769 34	923 11	39 "
87 38	3,000			40 "

By means of the table one can quickly follow the process through and see for himself that the net premium is precisely adequate. The figures assume the collection of that amount in each year from each living member. Interest at three per cent. is included from the first on all funds on hand. Every death claim is paid in full as it matures, according to the mortality table. At ninety-five there are but three members yet living. These pay their last premiums on that day, making the total net premium income of that year \$148.28. To this is added the terminal reserve of the preceding year, to wit: \$2,769.34, making an initial reserve for the fortieth year of \$2,912.62. Adding to this one year's interest, to wit: \$87.38, we get \$3,000, or just sufficient to pay the three remaining policies in full.

THE LIMIT OF LIFE

It is assumed in the mortality table that the last three members remaining at age ninety-five, will not live beyond the end of that year. The premium having been computed on that basis, the total insurance fund, that is, the reserve, must necessarily equal the face of the policy at that time, the end of the fortieth year, when the insured has reached the age of ninety-six. In other words, the reserve is equal to the face of the policy at the limit of life which, by the American Experience Table, is the attained age of ninety-six years—the age when the last man is presumed to die.

The fact that in actual experience men do sometimes live beyond the age of ninety-six, is not against but in favor of the sufficiency of our premium. If, for

example, the ultimate limit of life were in fact three-score and ten, or four-score years, none ever living beyond that period, our premium, computed on the basis of some attaining the age of ninety-six, would be insufficient. It will be seen by the Verification Table (pages 46 and 47) that the reserve on each policy at the end of twenty-five years amounts to only \$676.42. In other words, if the 12,883 members then remaining were all to die at that time, at the attained age of eighty-one years, the total funds on hand would suffice to pay only \$676.42 on each \$1,000 policy. If on the other hand, the three members remaining at age ninety-five shall continue to live beyond the attained age of ninety-six,—say to one hundred or longer, the fact will not affect the result. The reserve on hand is equal to the face of the policy—there can be no failure to pay the death claim when it occurs.

EXAMPLES OF REMARKABLE LONGEVITY

The American Experience Table indicates that out of 81,822 persons living at age 35, only 3 will still be living at age 95, and that none of these will live beyond the attained age of 96. The experience of The Mutual Life has been much better than that. It is commonly assumed that the average age at date of insuring is 35. Of the 470 persons insured in the first year of The Mutual Life, 2 lived beyond the age of 96. In that proportion (if each of the 470 persons had been 35 years of age at date of insuring), the American Experience Table would show 348 out of 81,822 living to age 96, instead of 3. These data, however, are too

meager to enable us to form an accurate conclusion. Taking larger figures, in the first four years the Company insured 8,126 persons. These have all passed away, 5 of them living beyond age 96. Proportionately, the American Experience Table, in the case of 81,822 persons at age 35, would show 131 attaining the age of 96 instead of 3.

The Company has already had 9 policyholders to live beyond the age of 96 out of 32,127 insured in the first 22 years. As many of those insured in that time are still living, some of whom may live beyond 96, we cannot give comparative results in figures, but it is evident that the mortality in The Mutual Life has been far more favorable than that indicated by the table. In this connection it must not be overlooked that many of the 32,127 policies issued in the first twenty-two years terminated by lapse or surrender, many term policies ended by expiry, and many endowment policies matured before the death of the insured. We have no record of the after-lifetime of these policyholders, some of whom probably lived, or will yet live, to age 96.

The following table is a record of the Company's experience up to November 3, 1915.

Policy Number	NAME	Date of Birth	Date of Issue	Date of Death	Age at Issue	Age at Death Yrs. Mos.
22	Chas. H. Booth	Sept. 30, 1803	Feb. 7, 1843	May 29, 1904	39	100 8
1,506	Robt. Street...	June 12, 1806	June 27, 1845	Feb. 1, 1903	39	96 8
2,228	Chas. Rhind..	Feb. 10, 1810	Feb. 27, 1846	Apr. 23, 1908	36	98 2
8,151	H. Blanchard.	Apr. 1, 1806	Mch. 13, 1850	Nov. 27, 1902	44	96 7
1,512	Jesse W. Hatch	May 20, 1812	June 30, 1845	Jan. 24, 1910	33	97 8
458	G. L. Newman	July 15, 1816	Jan. 24, 1844	Oct. 11, 1913	28	97 3
16,534	Jno. F. Mesick	June 17, 1813	May 13, 1856	June 30, 1915	43	102 —
13,869	Jno. P. Daniels	Apr. 28, 1815	Nov. 25, 1854	Nov. 11, 1912	40	97 6
32,127	Jas. M. Woltz.	Dec. 14, 1818	May 25, 1864	Nov. 3, 1915	45	96 11

John P. Daniels surrendered his insurance for the face amount in cash on attaining the age of 96. This is a privilege always accorded by The Mutual Life to policyholders who have lived to that age, for the reserve is equal to the face amount of the insurance at 96. It is a privilege, however, that has rarely been exercised.

Since the foregoing matter was put in type, another policyholder, Judge Nahum Morrill, of Auburn, Maine, has attained the age of 96 years, making ten policyholders in all who have passed the "limit of life" as fixed by the American Experience Table, up to December, 1915.

CHAPTER VI.

OBSERVATIONS ON THE RESERVE

"NEW BLOOD" NOT ESSENTIAL TO PERMANENCE

IN the Verification Table, pages 46 and 47, we have the mathematical proof that a regular life insurance company—the assumptions as to mortality and interest being realized—might cease writing new business altogether, and by continuing to collect from each member the requisite mathematical premium, would be able to pay all policies in full including that of *the last man*,—the balance on hand when the last policy matures at the attained age of ninety-six being just sufficient for that purpose.

RESERVE ALL FOR MORTALITY PURPOSES

The Verification Table illustrates, theoretically, the actual progress of a life insurance company from the beginning of its career to the fulfillment of its last contract. It illustrates also the fact that the so-called *Reserve* in life insurance is simply the insurance fund or mortality fund of the company, from which all policy claims are paid. Observe that at the beginning of the very first year the initial reserve, which the company under the law *must* hold on the day when it commences business, comprises the entire net premium income. Observe that thereafter the entire net premium receipts, plus 3 per cent. interest thereon at the assumed rate, constitute the actual insurance fund of the company, always

designated as the reserve. Note that the reserve is constantly applied to the payment of policy claims, until the last claim is met at age ninety-six, to which the last dollar of the net premium receipts and interest is devoted. In other words, the net premium is all for mortality purposes, or the payment of policy claims, and for nothing else.

SOME POPULAR ERRORS

Several primary text books, in attempting to explain in a simple manner the scientific features of life insurance, unwisely state that the gross premium is composed of three parts, to wit: the *Reserve Element*, the *Mortality Element* and the *Expense Element*. The statement is technically incorrect and has led to much confusion. The explanation is made that the reserve and mortality elements combined constitute the net premium, while by the term "expense element" is meant the loading, the three parts making up the gross premium.

Some of these elementary writers have published tabular exhibits purporting to show the division of the gross premium at the several ages into mortality, reserve and expense elements. These apparently authoritative statements seem to indicate, and have been interpreted by the uninformed to mean, that the so-called "mortality element" is the estimated necessary provision for payment of probable death claims, while the "reserve element" is supposed to be purely an accumulation for possible emergencies, such as extraordinary claims resulting from epidemics, etc.

Moreover, the division indicated is commonly understood to be fixed—the inference being that the amounts apportioned for mortality, reserve, and expense elements remain the same in the case of all future premiums. Most promoters of assessment schemes have so understood these figures, and many of these, by adopting as a net rate the so-called “mortality element,” plus an addition of perhaps twenty per cent. for possible excess mortality, have loudly proclaimed their conservatism and foresight in making a “larger provision for mortality” than is made by the so-called “old line” companies. The “old line” reserve they vaguely designate as the “investment element,” which is alleged to have no place in legitimate life insurance. In fact, the assertion is made by the promoters of such organizations that the reserve is never drawn upon for the payment of death claims. Even fairly well-informed persons have conceived the erroneous notion that the reserve is merely a special fund pertaining to each policy, formed by the accumulation of the “reserve element” of the premiums paid on that policy at a given rate of interest, and that such individual fund is never drawn upon, save as part payment of that particular policy when the same becomes a claim.

COMPOSITION OF THE PREMIUM

This aggregation of errors results largely from the confusion caused by the hypothetical division of the net premium into reserve and mortality elements. There is in reality no such division save as a bookkeeping expedient, designed to facilitate computations in connection

with the apportionment of surplus or the solution of similar problems. It is based upon the fact that only a part of the net premium income of the earlier years is required for the payment of current death claims, the balance being reserved to meet future claims; wherefore, in an individual statement of account, it has been found convenient to charge to *mortality* such proportion of the net premium as constitutes its pro rata contribution to the death claims of the year, while the balance thereof is carried to *reserve account*. Thus, for convenience sake merely, we may designate one portion of the year's net premium as the "mortality element" and the balance as the "reserve element," but it is nevertheless apparent, that the division as made is in no way fixed. The so-called elements necessarily vary in their relative proportions from year to year, just as the mortality of the company steadily increases with the age of the members, while the contribution from interest also increases yearly as the reserve grows larger.

We have referred to these errors at length, because they are still widely prevalent and constitute the basis of most assessment fallacies, making it quite essential that the solicitor in the beginning of his career should know how to meet and refute them.

Let us state then, as emphatically as possible, that the gross premium is *not* composed of three elements, "mortality, reserve and expense," but consists of two parts only, the net premium and the loading, and that the net premium is *all* for mortality purposes. As already stated, you have seen in your study of the Verification Table, pages 46 and 47, that there is but one "insurance

fund" from which all death claims are paid. This fund consists of the entire net premium receipts plus interest thereon at the assumed rate; and the *Reserve* is simply the *balance* of the fund on hand at any given time. That indeed is the literal meaning of the term. That portion of the insurance fund which has been expended has not been *reserved*. That which remains *is reserved* for the payment of the claims of succeeding years; hence its designation as "*The Reserve*." This balance is increased yearly by the addition of the current net premium income and interest at the assumed rate. It is likewise constantly drawn upon for the payment of claims. The balance on hand is always the reserve. (Verification Table, columns 5 and 8.) In short, there is absolutely no distinction between *mortality element* and *reserve element*, or between mortality fund and reserve fund, save the distinction between money which is expended now and money which is held for future disbursement.

CASH VALUES AND ENDOWMENTS: THEIR RELATION TO THE RESERVE

If a policy-holder surrenders his contract and withdraws from the company, the latter is relieved of further liability on account of that policy. It will never mature as a death claim. It is no longer necessary, therefore, to hold a reserve for that policy and accordingly the member may be permitted to withdraw as a *Cash Surrender Value* a sum not exceeding his proportionate share of the whole reserve. If less than the full

proportion of the reserve pertaining to the cancelled policy is allowed as a surrender value, the remainder no longer constitutes a part of the fund, but becomes surplus, available for subsequent apportionment among the remaining members as hereafter explained. The fund will then stand the same as if the withdrawing policyholder had never been a member of the company.

The Verification Table demonstrates the sufficiency of the ordinary life net premium. Had every member of our hypothetical company carried an endowment policy instead of an ordinary life, a similar computation would have proved likewise the sufficiency of the endowment net premium. Indeed, the ordinary life policy at age fifty-six as illustrated by the Table might be regarded as a forty-year endowment, since the reserve becomes equal to the face of the policy at the end of forty years, at the attained age of ninety-six. In reality, every life policy is the mathematical equivalent of an endowment policy in some form. This may be illustrated by the interesting case of Charles H. Booth, the first policyholder to attain the age of 96. Mr. Booth's policy was an ordinary life, issued at age thirty-nine. Fifty-seven years later, therefore, he reached the assumed limit of life, ninety-six years. The reserve then became equal to the face of the policy, the premium having been computed upon the assumption that he would not live beyond that age and that the face amount would then become payable. Had he applied for a fifty-seven year endowment at age thirty-nine, the face of his policy would likewise have become payable at age ninety-six. In either case the net premium would have been precisely the same and the

reserve on the two policies would have been identical in amount at every stage during the fifty-seven years. In other words, an ordinary life policy and a fifty-seven year endowment, issued at age thirty-nine, are mathematically identical. Likewise an ordinary life policy at fifty-six is, mathematically, a forty-year endowment issued at the same age. Every life policy is, mathematically, an endowment policy payable at age ninety-six. There is this difference, however, to be noted. While the reserve of a life policy is equal to the face amount at age 96, so that the policy may properly be paid in cash at that time, it is not, by its terms, payable until death, which may be several years later. On the other hand, a 40 year endowment issued at age 56 is by its terms absolutely payable at 96.

SINGLE PREMIUMS AND RESERVES

You have seen on page 19 that if each of the 63,364 members of our hypothetical company were to pay for his insurance with a single premium (\$621.18), we should have a total insurance fund of \$39,360,583.39. No further payments on the part of any member would ever be necessary, since the stated fund, with the help of interest at three per cent., would be precisely sufficient for the payment of all claims as they mature, including those of the last three members at age ninety-six. In other words, each member would hold from the start a fully paid life policy of \$1,000.

The following table shows the net single premium required for a fully paid whole life policy at every age from twenty to ninety-five:

**NET SINGLE PREMIUMS, OR RESERVE VALUES ON
PAID-UP POLICIES PER \$1,000**

Present Age	Net Single Premium or Reserve	Present Age	Net Single Premium or Reserve	Present Age	Net Single Premium or Reserve
20	\$830 94	46	\$514 80	72	\$796 67
21	835 68	47	524 23	73	806 28
22	840 57	48	534 07	74	815 70
23	845 62	49	544 70	75	824 98
24	850 82	50	555 22	76	834 01
25	856 18	51	565 89	77	842 97
26	861 72	52	576 71	78	851 80
27	867 48	53	587 67	79	860 49
28	873 82	54	598 74	80	869 06
29	879 89	55	609 92	81	877 42
30	885 64	56	621 18	82	885 60
31	892 09	57	632 51	83	893 68
32	898 73	58	643 89	84	901 59
33	905 58	59	655 30	85	909 51
34	912 63	60	666 72	86	917 52
35	919 88	61	678 18	87	924 88
36	927 36	62	689 51	88	932 02
37	935 04	63	700 83	89	938 75
38	942 95	64	712 08	90	945 28
39	951 07	65	723 24	91	951 58
40	959 42	66	734 27	92	957 49
41	968 00	67	745 16	93	962 81
42	976 80	68	755 89	94	968 84
43	985 83	69	766 42	95	970 87
44	995 10	70	776 73		
45	504 59	71	786 82		

If any large number of persons, say 100,000, all of the age of twenty years, were each to contribute toward a common insurance fund the net single premium of \$830.94, the total resulting fund of \$83,094,000 would be just sufficient with three per cent. interest for the payment of all outstanding policies as the same

mature according to the mortality table. Likewise at age fifty the net single premium required to accomplish this result would be \$555.22. At ninety-five the net premium required is \$970.87. If to that sum we add one year's interest at three per cent. (\$29.13), we shall have at the end of the year \$1,000, or just enough to pay the member in full at his then age of ninety-six.

But the total insurance fund on hand is always the reserve, and, dividing that fund by the number of living members, we obtain the reserve pertaining to each policy. One thousand members at age fifty, contributing each a net single premium of \$555.22, create a total insurance fund of \$555,220; and dividing that fund again by the number of members, we obtain necessarily the sum of \$555.22 as the reserve on each paid-up policy. In other words, the *net single premium at a given age is always the reserve on a paid-up policy at that age.*

To illustrate: Turn to the schedule of reserve values in your Life Insurance Manual or Handy Guide. Take the case of a fifteen-payment life policy issued at age twenty-five. It becomes paid-up at age forty. Note that the accumulated reserve then amounts to \$459.42, corresponding to the net single premium at that age as given in the above table. Or take a life policy issued at age thirty and paid for in ten equal annual premiums. This also becomes fully paid-up at age forty, and again you find the reserve at that age to be \$459.42. In short, for "Net Single Premiums" in the foregoing table, you may read "Reserve Values of Paid-up Policies," for the two terms are precisely equivalent.

THE RESERVE NOT THE PROPERTY OF THE INDIVIDUAL POLICY-HOLDER

It is scarcely necessary to point out that while the reserve on a paid-up policy at age fifty-six is \$621.18, the reserve on the same policy one year later, at age fifty-seven, will be \$632.51, and ten years later, at age sixty-six, will be \$734.27, as shown in the foregoing table, page 59. This enables us to correct another very common misconception as to the nature of the reserve.

The beginner often conceives the idea that the reserve is a distinct fund belonging to each policy—a fund which goes on accumulating at three per cent. interest until the death of the insured, when it is applied in part payment of his policy; or, if he continues to live, accumulating until he reaches the age of ninety-six years, when it amounts to the face of the policy. This view of the reserve is essentially erroneous. Take for instance the reserve of a paid-up policy at age fifty-six, to wit: \$621.18. Add three per cent. interest (\$18.64) and you obtain \$639.82, while the actual reserve one year later as shown by the table (see age fifty-seven), is only \$632.51. In like manner, compounding the interest for ten years on \$621.18, the reserve at fifty-six, you will obtain a much larger sum than \$734.27, the reserve at age sixty-six; while on the same basis the reserve of \$621.18 at age fifty-six would amount to \$1,000 long before reaching the age of ninety-six.

The error consists in assuming that the reserve is a distinct fund specifically belonging to each policy and never drawn upon until applied as part payment of that

policy at death. In life insurance the reserve is the common insurance fund belonging to the whole body of policy-holders,—not their property as individuals, but as a company. It does accumulate at three per cent. interest, but is constantly drawn upon, both principal and interest, for the payment of claims. For many purposes it may at any time become desirable to ascertain the pro rata portion of the reserve on hand pertaining to each policy in force, as we have done in this discussion, but this does not mean that the ascertained pro rata reserve is in any case a distinct fund actually belonging to that policy, or to the holder thereof as an individual. Neither can the terminal reserve, even in the case of a paid-up policy, be determined by adding three per cent. to the reserve of the preceding year for the reason that the fund is constantly drawn upon to meet the demands of the current mortality. At age ninety-five, and at that age only, this process will give the correct result, because the limit of life is reached at ninety-six.

RESERVE TABLES

In the Verification Table (column 9), is shown the pro rata terminal reserve for each year in the case of an ordinary life policy issued at age fifty-six. Tables have been constructed showing the pro rata reserve at the middle and end of every policy year, corresponding to various forms of policies issued at any age. The initial reserve, which is the reserve at the beginning of a policy year, is found by adding the terminal reserve of the preceding year to the net premium. The balance on hand at the *middle* of the *policy year* is termed the

Mean Reserve. It is, of course, one-half of the sum of the initial and terminal reserves of that year.

RAPID ACCUMULATION OF RESERVES

Referring again to the Verification Table, observe that, although no new insurance is written by our hypothetical company, the total reserve rapidly increases until the end of the fourteenth year, when it amounts to \$15,887,873.42. From that time on the aggregate amount decreases yearly because of the greater drain resulting from an increasing death rate.

Uninformed people are prone to conclude, on perceiving how greatly the premium receipts in the earlier years exceed the death claims, that we are collecting more money than necessary, and that the net premium is larger than need be. Advocates of assessmentism and of other unscientific forms of life insurance constantly urge this view; but to perceive the fallacy involved we have only to glance down the table to age sixty-eight, in the thirteenth year, to find the death claims already exceeding the premium receipts; while twelve years later, at age eighty, the yearly mortality is over three times the premium income.

Uninformed persons also complain of the enormous reserves piled up by life insurance companies, not knowing that the accumulation is merely the result of a low mortality in the earlier years, thus leaving a large balance on hand at the end of each year, every dollar of which, however, will be needed to meet the much higher mortality of later years. If the death rate were uniform through life, the same number per thousand dying at age

twenty as at age eighty—the premium, which would be the same for all ages, would be precisely sufficient for the payment of current death claims, leaving no balance at the end of the year, and no large accumulation would be necessary.

The reader will readily perceive that if new members in large numbers were added to our hypothetical company each year, the aggregate reserve would increase still more rapidly, and if the yearly additions to the membership were steadily maintained at a uniform rate, it would necessarily be many years before the accumulation of funds would become stationary; yet every dollar of this reserve would be needed ultimately for mortality purposes, being merely the balance on hand of the insurance fund mathematically necessary for the final payment of outstanding policies.

THE MEANING OF LARGE RESERVES.

As an illustration of the rapid accumulation of the reserve in actual practice, that of The Mutual Life Insurance Company of New York, which amounted to \$366,620,552.73 on the 31st of December, 1904, had increased ten years later, on December 31, 1914, to the sum of \$496,438,884, not including the Company's contingency reserve, reserve for supplementary contracts, and accumulations for deferred dividends of over seventy millions more. This increase has been merely commensurate with the rapid growth and increasing obligations of the Company, and the fund is no greater than it was ten years ago in proportion to the requirements of existing policy contracts. Likewise our "hypothetical company" (see Verification Table, pages 46 and

47) is no stronger at the end of eight years with a reserve of \$12,292,773.41, or at the end of fourteen years with a reserve of \$15,837,373.42, than at the end of its first year, with only \$1,857,110.99; since in each case the balance on hand is merely the amount which is mathematically necessary, in connection with future premiums called for by existing policies, for the ultimate payment of those policies. For the same reason the company is no stronger at the end of thirty-five years, when the pro rata reserve pertaining to each policy is \$872.18, than at the end of its first year when it is only \$29.90.

The amount of the reserve at any given time depends also upon the nature of the business written. Were the members of our hypothetical company each insured under a thirty-year endowment contract, the necessary reserve or insurance fund at the end of the thirtieth year would be \$4,193,000 instead of \$3,277,749.20, since the policies of the 4,193 members still living would all be payable in full at that time. In endowment insurance the reserve necessarily equals the face of the policy at the end of the endowment period, and (if the endowment is payable before age 96), is correspondingly larger in each preceding year than the reserve of a life policy. The reader will perceive the absurdity of exploiting the ratio of "Accumulated Reserves to Mean Insurance in Force," sometimes resorted to in comparing one regular life insurance company with another, the company with the larger reserves per \$1,000 of outstanding insurance (both being on the same reserve basis), absurdly claiming to be the stronger institution.

CHAPTER VII.

THE AMOUNT AT RISK

WHEN a life insurance policy matures as a death claim, the difference between the face of the policy and the terminal reserve may be regarded as the net loss to the company, for the reason that the pro rata reserve of the policy represents the amount of that policy's contribution to the insurance fund which still remains on hand. In other words, the pro rata reserve of the policy may be regarded as the amount which it contributes towards its own payment. The difference between the face amount of the policy and the reserve is therefore called the *Amount at Risk*, and the reserve itself has been termed *Self Insurance*.

These are technical terms, useful in the statement of certain propositions, but not to be understood in their literal sense. Strictly speaking, the maturing of a policy by death can not be regarded as a *loss* to the company, either in whole or in part, provided the mortality of the company is not in excess of that indicated by the table upon which its rates are based. (See page 34). It is the business of a life insurance company to pay death claims, and the entire cost of the payment, whether the particular policy has been in existence for a day or a year or for many years, has been provided for in the premium rates. The payment of a death claim is no more a loss to the company than is the payments of its ordinary expenses, full provision for the one item having been made in the reserve or insurance fund, for the other in the loading.

An endowment policy maturing by completion of the endowment period is technically and literally a *Claim*, not a *Loss*. On the other hand, a policy maturing by the death of the insured may be technically termed a *Loss*, but is literally a *Death Claim*. It is a claim for its face amount, and the *face* of the policy is literally, though not technically, the amount at risk. The latter term is in general use, and its technical signification is fully established and must be kept in mind. The use of the term will be clearly illustrated by the following table, based on the figures of our hypothetical company. (See Verification Table, pages 46 and 47.)

Age	No. of Members	Face of Policy	Terminal Reserve	Amount at Risk	No. of Deaths	End of Year
56	63,364	\$1,000 00	\$29 90	\$970 10	1,260	1
60	57,917	1,000 00	150 88	849 67	1,546	5
70	38,569	1,000 00	497 25	562 75	2,891	15
80	14,474	1,000 00	676 42	323 58	2,091	25
85	5,485	1,000 00	781 73	218 27	1,292	80
90	847	1,000 00	872 18	127 82	885	85
95	8	1,000 00	1,000 00	0 00	8	40

COST OF INSURANCE

Taking the amount at risk in its technical sense as the actual loss in the case of a death claim, we determine the mortality cost, or *Cost of Insurance*, for the year as follows. At age fifty-six the amount at risk on an ordinary life policy in the first year is \$970.10. Of the 63,364 members comprising our hypothetical company, 1,260 will die during the year, making the net loss \$970.10 multiplied by 1,260 or \$1,222,326.00, which is the total cost of insurance for the year. Dividing this amount by 63,364, the number living at the beginning of the year, we obtain \$19.29, which is the pro rata cost of insurance

per \$1,000 for the first year. In the fifth year the amount at risk is \$849.67, and multiplying this by 1,546, the tabular number of deaths, we get \$1,313,589.82 as the total cost of insurance for the year. Dividing by 57,917, the number living at the beginning of the year, we obtain \$22.68 as the cost of insurance per \$1,000 in the fifth year. At ninety the amount at risk is \$127.82 and the total cost of insurance is that sum multiplied by 885, or \$49,210.70. Dividing by 847, the number living at the beginning of the year, we obtain \$58.10 as the cost of insurance per \$1,000 in the thirty-fifth year.

MORTALITY

The death rate per 1,000 lives as indicated by the mortality table is termed the *Tabular Mortality*. If the lives insured have been well selected, the *Actual Mortality* will probably be less than the tabular, or that which was expected according to the table. If in the fifth year of our hypothetical company, for instance, the number of deaths should be only 1,500 instead of 1,546, the actual cost of mortality would be the amount at risk, \$849.67, multiplied by 1,500, the actual number of deaths, or \$1,274,505. In that case we should have:

Total cost of Insurance, or		
<i>Expected Mortality</i>	- -	\$1,313,589.82
<i>Actual Mortality</i>	- - -	1,274,505.00
<i>Saving in Mortality</i>	- -	<u>\$39,084.82</u>

In legitimate life insurance the ratio or percentage of "Death Claims Incurred to Mean Amount of Insurance in Force," so often exploited in competitive literature, is of no significance whatever since it ignores

two essential factors—the ages of the insured and the amount of reserves accumulated. Likewise the ratio of the “*Face Amount of Death Claims Incurred to the Face Amount of Expected Death Claims*” is misleading, for the reason that again the accumulated reserves are ignored. Only by comparing the total amount at risk on accruing claims (actual mortality) with the total amount at risk on expected claims as indicated by the mortality table (“cost of insurance” or expected mortality), can we determine whether or not there has been a *Saving in Mortality*.

To illustrate: Our hypothetical company has at the beginning 63,364 members at age fifty-six, with \$63,364,000 insurance in force. (See Verification Table, pages 46 and 47, also Amount at Risk, page 66). Twelve hundred and sixty members, according to the table, are dead at the end of the year, making total death claims \$1,260,000. Dividing we obtain the ratio of “Death Claims to Insurance in Force,” to wit: \$19.88 per \$1,000, or practically twenty deaths per thousand members. ($\$1,260,000 : 63,364 = \$19.88$.) In the same way the “insurance in force” during the fifteenth year, when our members have attained the age of seventy years, is \$38,569,000, the death claims \$2,391,000, and the mortality per \$1,000 is \$61.99, or nearly sixty-two deaths per thousand members. In this instance the apparent mortality, or the ratio of death claims to insurance in force, is over three times that at age fifty-six; and yet in either case we have only the normal mortality, or precisely what we counted on and provided for in the computation of the premium.

The apparently high death rate at seventy does not affect the financial condition of our hypothetical company, conducted as it is on a plan which is mathematically correct. In fact, without increasing premium rates in the least, it is precisely as easy, because of the accumulated reserves, to meet the mortality of \$61.99 per \$1,000 at age seventy as that of \$19.88 at age fifty-six. Indeed, notwithstanding the death claims at seventy are largely in excess of the premium income—in excess, in fact, of total income—the reserve pertaining to each policy in force at the end of the year has grown to \$437.25, an increase of \$26.63 over that of the previous year (see Verification Table, pages 46 and 47). In the same way at age eighty-five, with \$235.55 of death claims per \$1,000 of insurance in force, and with total death claims amounting to nearly five times the premium income and to over three times the total income, the mortality is promptly met, while the individual reserve increases as before from \$761.12 to \$781.73. That is to say, in legitimate life insurance, so long as the actual mortality does not exceed the expected, it is immaterial whether the ratio of death claims to mean insurance in force is \$19.88, or \$61.99, or \$235.55 per \$1,000; i. e., whether the death rate is 20, or 62, or 236 per 1,000 members. The mortality is precisely what was expected and what has been provided for, and is as easily met in the one case as in the other.

On the other hand, in assessment life insurance a death rate in excess of ten per 1,000, or a mortality of more than ten dollars per \$1,000 insurance in force, is *significant*; for it means increasing assessments and

cost, with the inevitable result of a decreasing membership and ultimate dissolution. The relatively small emergency funds of the assessment society are insufficient to meet the increasing death claims pertaining to the increasing ages of the several members. In legitimate life insurance the reserve pertaining to each policy increases proportionately with the advancing age of the policy-holder, and the ratio of *Actual to Expected Mortality*, which takes into account these accumulating reserves, is alone of any significance.

THE AVERAGE AGE

In 100,000 persons all of the age of thirty-five years, the tabular or expected deaths according to the American Experience Table (see page 13) will be 895, a mortality rate of 8.95 per thousand. In the same number of persons of various ages but with an *average* age of thirty-five, the tabular or expected mortality may or may not be 8.95 per thousand. It depends upon the relative proportions of young and aged members, not upon the *average* age. For example: In 50,000 persons all of the age of twenty years, the tabular number of deaths will be 390. In the same number of lives at age fifty the tabular deaths will be 689. The *average* age of the 100,000 persons will be thirty-five, but the total deaths according to the mortality table will be 1,079, $(390 + 689)$, a death rate of 10.79 per thousand. Thus it is apparent that the average age of a body of men is of little significance. The normal or tabular death rate at age thirty-five is 8.95, but in a body of men

whose *average* age is thirty-five, an actual mortality of 10.79 or more may or may not be excessive. All depends upon the several ages of the individual members. Nothing can be predicated upon the average age.

PROBABILITY OF DYING

At age fifty-six, of 63,364 persons, 1,260 will be dead at the end of one year according to the American Experience Table of Mortality. The *Probability of Dying* within the year, therefore, will be represented by the fraction $\frac{1,260}{63,364}$. This fraction is equivalent to the decimal .019885, which means a death rate of 19.88 per 1,000. Of the same body of men there will be 62,104 still living at the end of the year, so that the *Probability of Living* through the year will be $\frac{62,104}{63,364}$, equivalent to the decimal .980115. Observe that the sum of the two decimals is unity, the probability of living being the complement of the probability of dying.

Again, of 63,364 persons living at age fifty-six, 2,585 will be dead at the end of two years, the probability of dying within that period being $\frac{2,585}{63,364}$, or .040796, while the probability of living beyond that period is $\frac{60,779}{63,364}$, or .959204.

THE EXPECTATION OF LIFE

The *Expectation of Life* is the average length of time that a number of persons of a given age will live according to the specified table of mortality. Thus, taking the case of our hypothetical company, it is assumed by the American Experience Table (Page 13), that of the 63,364 persons living at age fifty-six, three will live thirty-nine complete years, to age 95—the last

one of the three not beyond age 96,—eighteen will live thirty-eight full years, 2,091, twenty-four full years, 1,980, nine full years, 1,260, less than one full year, etc., and that the whole body will live for an average time of 16.72 years, which is accordingly the expectation of life at age fifty-six. A better term than “expectation of life” is that of *Average Future Lifetime*, or *Average After-Lifetime*.

The expectation of life at a given age does not mean that one-half of all persons living at that age will die in that time. For example: At forty-three, the expectation of life is twenty-six years, but it does not follow that half the persons now living at age forty-three will die within the next twenty-six years. On the contrary, by reference to the mortality table (Page 13) it will be seen that of 75,782 persons living at forty-three, 40,890, or considerably more than half, will still be living twenty-six years later at age sixty-nine. One-half of the original number, 37,891, according to the Table, will die within twenty-seven years, three months and twelve days. This period—the length of time during which one-half of the persons of a given age will continue to live—is technically termed the *Probable Life*—the French term, *Vie Probable*, being commonly used. The term is not a satisfactory one, since there is in every case a definite probability, according to the Table, of living to any age up to ninety-six, the degree of probability varying according to the length of the period under consideration. In as much as 40,890 of 75,782 persons living at age forty-three will still be living at age sixty-nine according to the table, the probability at the former age of living to

sixty-nine, will be expressed by the fraction $\frac{40,820}{75,782}$, while the probability of living fifty years, or to age ninety-three, will be expressed by $\frac{79}{75,782}$, or .001042, since out of 75,782 persons at forty-three, seventy-nine will still be living at ninety-three.

The foregoing observations sufficiently illustrate the fallacy involved in the notion entertained by the advocates of assessment insurance that the expectation of life has any relation to the cost of life insurance. It is an error to suppose that a man who bids fair to live through his expectation of life is *for that reason* a good risk, or that the man who has paid his premiums for that length of time has paid the full cost of his insurance. If every member of our hypothetical company still living at the end of seventeen years—his expectation of life—were then to be relieved of paying further premiums, the total receipts from that source would be reduced by several millions (see Verification Table, pages 46 and 47), and the net premium of \$47.76 would have to be materially increased.

The distinction should be made between the probability of dying within a certain number of years, and the probability of dying in *a particular year*. At forty-three, the chances of dying within twenty-seven years, three months and twelve days, or of living beyond that period, are even; but, while a man of forty-three is more likely to live to sixty-nine than to seventy-five, he is at the same time more likely to die at seventy-five than at the particular age of sixty-nine, since out of 75,782 living at forty-three, 2,476 will die at seventy-five, against 2,321 at sixty-nine. Again at age thirty-five the expectation of life is 31.78 years, but the probability

of dying in the thirty-second year thereafter, at age sixty-six, is not so great as that of dying in the thirty-third, or in the fortieth, or even in the forty-fifth year.

EXPECTATION OF LIFE NOT USED IN COMPUTING COST OF LIFE INSURANCE

The expectation of life cannot be used in computing the premium for the reason that the computation of compound interest as involved in the cost of life insurance is impossible on the basis of the average after-life-time. Compound interest is an essential factor in the computation of the premium, but, for the reason stated, the calculation must be made from year to year instead of upon the basis of the average time involved. The theory that the expectation of life may be used as a basis for computing the probable cost of life insurance, is one of the widespread errors of assessmentism, which the intelligent life agent should be prepared to refute.

CHAPTER VIII

THE LOADING

UP to this point we have dealt with the net premium only, the whole of which is calculated for mortality purposes. As a provision for expenses and other contingencies, a specified sum called the *Loading* is added to the net premium, the two combined making up the gross premium as given in the rate book.

The *Loading* is sometimes a percentage of the net premium; in other cases it is composed of two parts—a constant sum (as \$2.00 per \$1,000 of insurance the same at all ages), and a percentage of the net premium; while various other methods are employed, the plan varying with different companies, and often with different forms of policies in the same company.

On the theory that it costs no more to care for a policy issued to a member sixty years of age, than for one issued at age forty or twenty, the claim is sometimes made by the advocates of assessmentism, that the loading should be a constant sum at all ages, instead of being, in whole or in part, a percentage of the net premium. This position rests upon a false premise—that the loading is for expenses only. The theory is also untenable on other grounds.

The loading is *not* for expenses only, but is intended to provide for all other possible contingencies, such, for instance, as a mortality in excess of the tabular rate, interest earned less than the assumed rate, depreciation in the values of securities, loss of invested funds, etc.

While the assumptions as to interest, mortality, etc., in the computation of the premium, have been on the most conservative basis, nevertheless, so long as human judgment is fallible, the possibility of error must be conceded. The foundation principle of life insurance is safety, and if mistakes are to be made at all, they must be made on the side of safety. It is better to collect too much money than too little; hence the importance of making provision for unforeseen contingencies. But mortality, interest, investments, etc., all affect the cost of life insurance; wherefore, that part of the loading which is designed to cover possible excessive mortality, deficit in interest earnings, etc., has a direct relation to the cost of the insurance, and, like the net premium, must vary with the age of the insured. This is accomplished by making it a percentage of the net premium.

Neither is it true that the expense incident to a policy issued at sixty is no more than that pertaining to a policy issued at forty or twenty. The chief item of expense with any company is that of commissions, and this is almost universally a percentage of the premium; wherefore the "loading" to provide for that expense must be greater at sixty than at forty or twenty. Taxes levied by the various states are an important part of a company's expenses, and these also are almost always a percentage of the premium income.

It is the common practice of assessment people to refer to the loading as exclusively an appropriation for expenses, charging directly that it is *all* applied to that end. In refutation of this charge the agent will explain the true office of the loading as set out above, and will

also point out the fact, that so much thereof as may not be required for the purpose designated is subsequently returned to the policy-holder when a division of savings is made. For example: Of the loadings collected by The Mutual Life Insurance Company in 1914, there remained at the end of the year an unexpended balance of no less than \$2,770,722.42 available for return to policy-holders.

TO ASCERTAIN THE LOADING

The amount of the loading can be ascertained by taking the difference between the net and gross premiums. Tables of net premiums and reserves for various forms of policies at the several ages and on different reserve bases are published in convenient form for reference. For example: The net premium of an ordinary life policy of \$1,000, issued at age thirty-five, American Experience Table and three per cent. interest, is \$21.08. If the gross premium for such a policy is \$28.11, the difference, \$7.03, will be the loading.

The net premium of a particular policy, however, cannot always be ascertained from the published tables, since the amount depends upon the guarantees contained in the contract. To illustrate: On an ordinary life policy of the usual form but on a three and a half per cent. reserve basis, the net annual premium at age thirty-five is \$19.91, and the regular reserve at the end of twenty years will be \$310.75. On such a policy, however, as issued in the past by The Mutual Life, with a twenty-year distribution period and a gross premium of \$27.88, the company guarantees a cash surrender value

at the end of twenty years of \$389.00, which necessarily requires a larger net annual premium than \$19.91.

The Cash Value, or Cash Surrender Value of a policy is the amount which the company will pay to the withdrawing policy-holder in cash for the surrender and cancellation of his contract. It is usually a large fraction of the reserve pertaining to the policy, rarely the full reserve until after some years. Inasmuch as, theoretically, only the good risk will surrender his policy for cash, the invalid preferring to maintain his insurance in force, it is customary for a company to retain a part of the reserve pertaining to withdrawing policies, as a *Surrender Charge* to compensate for the anticipated selection against the company. (See page 56).

In view of the guaranteed cash surrender value of \$389.00 on the policy above described, persons not versed in the scientific principles of life insurance sometimes assert that The Mutual Life is offering a cash value of \$78.25 in excess of the accumulated reserve, a practice which they characterize as unwise if not dangerous. The answer is simply that the cash value named is *not* in excess of the reserve actually held by the company against that policy. If, for example, the contract, instead of being an ordinary life of \$1,000, were a twenty-year pure endowment of \$389.00, with term insurance of \$1,000, everyone would readily understand that the company would necessarily hold a *reserve* of \$389.00 at the end of twenty years, since the reserve must equal the face of the endowment at the end of the endowment period. Now, although The Mutual Life contract referred to is in form an ordinary life with a gross premium of only \$27.88, inasmuch as the company guarantees

to pay \$389.00 cash at the end of twenty years, the policy becomes virtually a twenty-year pure endowment for that amount (besides the \$1,000 term insurance), and under the law the company is required to accumulate against it a reserve to the full amount of that endowment, to wit: \$389.00. In other words, every company is obliged to maintain a reserve sufficient to make good every guarantee contained in its contract.

To accumulate a reserve of \$389.00 in twenty years necessarily requires a larger net premium than to accumulate one of \$310.75. It follows that the net premium of The Mutual Life policy described is considerably more than \$19.91, and the loading correspondingly less than \$7.97.

The cash values of The Mutual Life on deferred distribution policies, issued since 1898 with a dividend period of fifteen or twenty years, which includes most of the business written between 1898 and 1907, are larger than those guaranteed by most other companies, even though the latter may be on a higher reserve basis and collect a larger gross premium. This simply means that the loading in the case of the Mutual Life policy under discussion is less, and that the company sets aside a somewhat larger part of the gross premium for reserve, and a somewhat smaller amount for expenses and contingencies.

A MISLEADING RATIO

The foregoing observations illustrate the unfair and misleading character of such a ratio as that of "Expenses Incurred to Loading Earned." It is very

often the case that the company which shows the smaller ratio of expenses to loading is able to do so by virtue of the fact that it has a much larger loading to start with than its competitor. With the same gross premium, the former may have a loading of \$7.97, while the latter has but \$5.00 or \$6.00. The former may have a saving from loading, simply because it has a large loading to begin with. The latter may have no saving from this source and yet be the more economically managed of the two; or, it may have a very large saving from loading, as The Mutual Life has, but in either case the ratio would fail to give it proper credit.

NET VALUATION

The insurance laws of the several states require every regular life insurance company to have on hand at all times cash or approved securities not less in amount than the *Net Value* of its outstanding policies, according to the *Minimum Legal Standard of Valuation*.

By *Net Value* is meant the amount of the reserve pertaining to the policy at any stated time. It is always the difference between the present worth of the net premiums to be paid on the policy, and the present worth of the benefits guaranteed thereunder—such as amounts payable at death, at maturity, on surrender, etc.

Net Valuation is the process of determining the legal net value or reserve of a company's outstanding policies, the net premium only—not the gross premium—being considered. To understand what is meant by the term *Minimum Legal Standard of Valuation*, observe that, in the computation of the premium it is

assumed that the reserve will earn a specified rate of interest. In the case of our hypothetical company the rate assumed is three per cent. On this basis, the required net annual premium of an ordinary life policy issued at age fifty-six was found to be \$47.76. The reserve or insurance fund, consisting of the net premium receipts plus the interest earned thereon at the assumed rate, suffices for the payment of all existing policies at maturity.

It is obvious that, in order to accumulate a specific sum of money, as the reserve of a life policy, within a stated time by means of small yearly deposits or premiums, the deposits must be larger, and the fund on hand at any time prior to age 96 must be greater, if the interest to be added to the fund is at the rate of only three per cent. than if three and a half or four per cent. interest is to be received. It is, therefore, equally clear that, if the net premium receipts of a life insurance company were certain to earn three and a half or four per cent. interest, the premium rates necessary to provide funds sufficient for the payment of all policies at maturity would be smaller than when it is assumed that only three per cent. interest will be realized. In other words, when the reserve is to be accumulated at three per cent. interest, larger net premiums are necessary than when a higher interest rate is assumed.

In all cases, whatever the rate of interest assumed, the reserve at the attained age of ninety-six is equal to the face amount of the policy. Observe that in our Verification Table the reserve at the end of the thirty-ninth year at the attained age of ninety-five is \$923.11. That sum plus the next year's net premium, \$47.76, plus

three per cent. interest, amounts to \$1,000 at the end of the year at the attained age of ninety-six. Had it been assumed in the computation that the funds would earn four per cent., the required net premium would have been only \$45.00 instead of \$47.76, and the reserve at the attained age of ninety-five would have been \$916.54, instead of \$923.11. Observe that \$916.54, plus the next year's net premium of \$45.00, plus four per cent. interest, likewise amounts to \$1,000 at the end of the year at the attained age of ninety-six. Thus, as stated before, the higher the rate of interest assumed, the smaller will be the reserve pertaining to any policy. A three and one-half per cent. reserve is larger than one computed on a four per cent. basis and smaller than a three per cent. reserve.

The laws of the several states prescribe the maximum rate of interest that may be assumed, and the mortality table that shall be used, in computing the reserve or net value of a company's policies. This requirement is termed the *Legal Standard of Valuation*. The net value computed by the legal standard is termed the *Legal Net Value* or *Legal Reserve*. In several states the rate of interest fixed by the *Minimum Legal Standard*, or the lowest standard prescribed by law, is four and one-half per cent.—in others four per cent. In New York, Massachusetts, and one or two other states, the minimum legal standard calls for three and one-half per cent. interest, so that a company whose premiums are computed on a four per cent. reserve basis must, in order to do business in those states, submit to a valuation by the higher standard of three and one-half

per cent. Many companies, such as The Mutual Life, have recently adjusted their premiums for new business to a 3 per cent. basis, and are accumulating 3 per cent. reserves accordingly, notwithstanding the lower minimum standard authorized by law.

DETERMINING THE NET VALUE.

Knowing the ages of the several policy-holders, we may determine how many of these, according to the mortality table, will die in each year thereafter, and how many will be living at the end of each year, and hence may compute the amount of claims to be expected in each year until all existing policies have matured, either by the death of the policy-holder or the expiration of the term for which the contract was written. Having these data we may compute the present worth or present value of all outstanding policies—that is, the sum which accumulated at a given rate of interest, say three per cent., will make an amount sufficient to pay every policy in full as the policies mature. (See Computation of Premium, page 12).

In like manner, knowing how many policy-holders will be living according to the table at the beginning of each subsequent year, to pay the premiums called for by the several policies, we may determine the net premium income of each year until the last existing policy has matured. Hence we may compute the present worth of all future net premiums to be collected on outstanding policies.

Let us now take for illustration the case of a company which has just issued 100,000 policies, aggregating

a total of \$100,000,000 insurance. Assume that the present worth of those policies—that is, the present worth of the benefits to accrue under their terms, is found to be \$37,055,000. This sum then constitutes the present value of the policy obligations which the company has assumed. To pay these policies as they mature, the company has no other certain resource than the net premiums stipulated to be paid thereon plus the interest which those premiums will earn at the assumed rate, say three per cent. If now the present worth of these premiums is likewise found to be \$37,055,000, it is obvious that the company is solvent and will—if three per cent. interest is earned and the mortality does not exceed that indicated by the table—be able to meet its obligations at maturity. A statement of its assumed condition would be as follows:

CREDIT SIDE.

Present worth of net premiums to be collected	
on existing contracts	\$37,055,000

DEBIT SIDE.

Present worth of benefits under outstanding	
policies	\$37,055,000

Such would be the exact status of a legally solvent mutual company the day it begins business, after a number of policies have been written but before any premiums have been collected.

Let us, however, take the same company after several years' premiums have been collected and a number of policies paid, a reasonable amount of new business having been written in the meantime. As some of the net premiums called for by existing contracts have been

received and disbursed, the present worth of the premiums remaining to be collected will no longer equal the present worth of benefits under policies now outstanding. Assume, for example, the present worth of those benefits to be now \$38,000,000, and the present worth of future net premiums, \$34,000,000. The present worth of benefits promised, or obligations assumed, will be larger than at first, because every existing policy is nearer maturity, while the present worth of net premiums to be collected in the future will be less than before, because some part of the premiums originally called for by every existing policy have already been collected. Our debits then in this case would exceed our credits by \$4,000,000, and the statement would now be as follows:

CREDIT SIDE

Present worth of net premiums to be collected	
on existing policies	\$34,000,000
Deficit	4,000,000
	\$38,000,000

DEBIT SIDE

Present worth of benefits under outstanding	
policies	\$38,000,000

The company is now clearly insolvent under the law, for the present worth of net premiums to be received—its only apparent resources—is \$4,000,000 less than the present worth of the benefits to be paid. This deficit represents the *Legal Reserve Liability* of the company—that is, the *Net Value* of its outstanding policies according to the legal standard of valuation, being the difference between the present worth of the benefits for which the company is liable under its policies, and the

present worth of all the net premiums to be received. If the company, however, after providing for the tabular mortality and matured endowments, has reserved from year to year the balance of its net premium and interest income, the funds so reserved will now aggregate exactly the amount of the computed reserve liability. In other words, it will have on hand the reserve required by law to maintain solvency, and the statement of its condition will now assume the following form:

CREDIT SIDE

Present worth of net premiums remaining to be collected on existing policies.....	\$34,000,000
Reserve (cash and invested funds).....	4,000,000
	<u>\$38,000,000</u>

DEBIT SIDE

Present worth of benefits contracted for in outstanding policies	\$38,000,000
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This suggests the definition of the legal reserve given above, to wit: "A fund equal in amount to the excess of the present value of benefits under outstanding policies over the present value of net premiums to be paid on those policies."

On the basis of the statement as last rendered, the company is technically solvent, since the credits and debits are equal. The form of the statement may be simplified by eliminating the two items, "Present worth of net premiums" and "Present worth of policies," and simply carrying to the debit side of the account the *difference* between the present worth of policy obligations and the present worth of premiums to be collected, which

is the company's *legal reserve liability*, or the *net value* of the benefits guaranteed under its outstanding policies. As the company holds cash and invested funds to the amount of this liability, the statement will assume the following form:

CREDIT SIDE

Cash, invested funds, and credits (*Assets*) . . . \$4,000,000

DEBIT SIDE

Net value of all outstanding policies (*Liability*) \$4,000,000

THE TEST OF SOLVENCY

The comparison of a company's *Admitted Assets*—money, invested funds and valid credits approved by the insurance authorities—with its total liabilities constitutes the legal test of its solvency. By the financial statement last above set out, the company in question is legally solvent—its assets being exactly equal to its liabilities; nevertheless, a company in just that condition would in fact be upon the verge of bankruptcy, for the loss of a small amount by depreciation of values, extra mortality, or other cause, would render it *insolvent* under the law. Such being the case, it is of the first importance for every company to maintain as a margin of safety an additional fund in excess of all legal liabilities, variously termed “surplus,” “indivisible surplus,” “unassigned funds,” etc. Under the New York law this extra fund or margin of safety is called the *Contingency Reserve*. Assuming that the company in question has such additional funds to the amount of \$1,000,000, a statement of its financial condition would then read:

ADMITTED ASSETS

Cash, invested funds, and credits.....\$5,000,000

LIABILITIES

Net value of all outstanding

 policies\$4,000,000

Contingency reserve (surplus).. 1,000,000 \$5,000,000

A MISLEADING RATIO

In the above case, a loss of assets in excess of \$1,000,000 would sweep away the contingency reserve and render the company insolvent. The smaller the amount of such additional fund, the more imminent the danger. It is obvious, therefore, that the measure of a company's strength is to be gauged rather by the *amount* of extra or surplus funds which it holds in addition to the legal reserve or net value of its outstanding policies, than by the *percentage* which such extra funds are of the total liabilities, i. e., the company's "*Ratio of Assets to Liabilities.*" For example: According to the statistics for 1914, a certain company of well-known excellence had surplus funds at the end of that year of more than \$4,000,000, and a ratio of admitted assets to liabilities of 106.5; that is, its assets exceeded its liabilities by only 6½ per cent.

On the other hand, the assets of a smaller company of considerable prominence exceeded its liabilities by twenty-nine per cent., yet its total surplus funds were less than \$180,000. Assuming that the assets in each case were of the highest class, there can be no doubt as to the

relative strength of the two organizations—the fact being the reverse of what might be inferred if only the ratios cited were to be considered. A surplus of only \$180,000 might readily be wasted or lost in a single transaction—far more readily, it will be conceded, than a surplus of more than \$4,000,000. A still more striking illustration of the misleading character of this ratio is afforded by the figures of a still smaller company with a ratio of assets to liabilities of 592 and a total surplus of less than \$21,000.

RESERVE BASIS MUST BE CONSIDERED

There is another test, however, that is too often overlooked by the ordinary insurance man as well as by the insuring public, and that is the question of reserves. Let us compare two companies, A and B, assuming that each has \$100,000,000 of insurance in force, all issued 10 years ago, at age 40, on the ordinary life plan. Let us also assume that each company, by the valuation of the insurance department, shows a surplus of \$1,000,000. The natural assumption would be that the two companies are of equal strength, but this does not necessarily follow. Neither company knows in advance what rate of interest will be earned during the entire existence of its outstanding policies. In order to be on the safe side, Company A assumes that it will earn as little as $3\frac{1}{2}$ per cent. and, accordingly, it must create and maintain a reserve or insurance fund which, with future net premiums received and interest added thereto yearly at $3\frac{1}{2}$ per cent., will suffice for the payment of all accruing claims each year until the total of \$100,000,000 has been

paid. Company B, still more conservative, bases its calculations upon earning only 3 per cent. Accordingly, it must create and maintain a reserve which, with future net premiums received and only 3 per cent. interest added thereto yearly, shall likewise be sufficient for the payment of all accruing claims, until the total of \$100,000,000 has been paid. As both companies are to pay the same amount ultimately, it is obvious that Company B, which adds only 3 per cent. to its reserve each year, must at all times maintain a larger fund than Company A, which adds $3\frac{1}{2}$ per cent. yearly. This illustrates the fact that a 3 per cent. reserve, at any and every date until the last policy matures, must be larger than a reserve based on $3\frac{1}{2}$ per cent.

TABULATED ILLUSTRATION

Each company has \$100,000,000 of outstanding policies all written 10 years ago at age 40. Turning to your reserve tables you will find that the reserve of an ordinary life policy issued ten years ago at age 40 on a $3\frac{1}{2}$ per cent. basis would amount now to \$166.89 per \$1,000, and on 100,000 policies of \$1,000 each, the total reserve would be \$16,689,000. The reserve tables also show that the 3 per cent. reserve of an ordinary life policy issued ten years ago at age 40 would now be \$177.20 per \$1,000, while the total reserve on 100,000 policies of \$1,000 each would be \$17,720,000, the amount held by Company B. As each company has \$1,000,000 of surplus, the financial statement in each case would be as follows:

COMPANY A

Reserve, $3\frac{1}{2}$ per cent.....	\$16,689,000
Surplus	1,000,000
Total Assets.....	\$17,689,000

COMPANY B

Reserve, 3 per cent.....	\$17,720,000
Surplus	1,000,000
Total Assets.....	\$18,720,000

Company B's reserve exceeds that of Company A by \$1,031,000; but, if a $3\frac{1}{2}$ per cent. reserve is large enough for Company A, it should be large enough for Company B. If, therefore, we value the latter company's business on a basis of $3\frac{1}{2}$ per cent., the excess in the reserve of Company B will be transferred to surplus, and the two financial statements will stand as follows:

COMPANY A

Reserve, $3\frac{1}{2}$ per cent.....	\$16,689,000
Surplus	1,000,000
Total Assets.....	\$17,689,000

COMPANY B

Reserve, $3\frac{1}{2}$ per cent.....	\$16,689,000
Surplus	2,031,000
Total Assets.....	\$18,720,000

It now appears that our 3 per cent. company, valued on a $3\frac{1}{2}$ per cent. basis, the same as Company A,

has a surplus more than double that of the latter company. It is obvious, therefore, that, in quoting surplus as a test of strength, the reserve basis must be considered. With equal surpluses, the 3 per cent. company will be stronger than one on a $3\frac{1}{2}$ per cent. basis; and the former may even have the smaller surplus and yet be the stronger company. In the foregoing examples, Company B valued on a 3 per cent. basis, might show a surplus of less than half a million—indeed, it might show no surplus at all—and yet be stronger than Company A; for, in the latter case, on a $3\frac{1}{2}$ per cent. valuation, it would still have a surplus of \$1,031,000 against a surplus of \$1,000,000 for Company A.

Another extremely important point as between different reserve bases is this: A 3 per cent. company will make surplus more rapidly than a $3\frac{1}{2}$ or 4 per cent. company. For example: suppose companies A and B both to be earning a net rate of $4\frac{1}{2}$ per cent. interest. All interest earned by Company A in excess of $3\frac{1}{2}$ per cent.—that is, one per cent.—becomes surplus, while Company B has the excess over 3 per cent.—that is, one and one-half per cent.—or one-half more than Company A. It is obvious that Company B will the more quickly recover from unexpected losses, will the more quickly restore a depleted surplus, and the more readily withstand any unusual strain.

Several modifications of the system of net valuation described in the foregoing pages have been established by recent legislation and will be explained in a later chapter. (Page 119 et seq.)

THE ANNUAL STATEMENT.

The laws of the several states require every regular life insurance company to file with the insurance department in every year as of the date of December 31, a sworn statement of its assets and liabilities, including the legal net value or reserve of all outstanding policies as determined by the minimum standard of valuation. As every such company is required under the law to maintain at all times a reserve not less in amount than the net value of all policies in force, such organizations are called "*Legal Reserve*" companies. They are also sometimes termed "*Old Line*" to distinguish them from *Co-operative*, *Stipulated Premium*, *Fraternal*, and other assessment organizations whose premium rates or assessments are not fixed, but are subject to increase as experience may demand. These assessment societies are not required by law to maintain an adequate reserve, nor are they subjected to any standard system of valuation to determine their solvency or the sufficiency of their rates, save that in certain states fraternal societies must submit to valuation, although not yet required to maintain mathematical solvency. So long as the funds on hand are sufficient to meet accrued death claims, little or nothing more is required of them. Future deficits are to be met by an increase of rates or a scaling down of death benefits, but the members of such assessment societies are prone to regard the probability of such a contingency as quite remote.

CHAPTER IX

GAINS OR SAVINGS IN LIFE INSURANCE

IN the computation of the premium it was assumed that the mortality of our hypothetical company would correspond with the American Experience Table and that our funds would earn just three per cent. interest. Upon this hypothesis the net premium is precisely sufficient for the payment of all claims that may accrue. It follows that if the mortality of the company should exceed that of the table, and the rate of interest earned should be less than that assumed, our premium would be inadequate and our reserve would fall short of the requirements. It would be impossible, however, to construct an infallible table—one that would indicate with absolute accuracy the mortality to be experienced. Inasmuch then as our actual death rate will certainly differ somewhat from the tabular, it is of the first importance that the variation be on the side of safety—a lower rather than a higher mortality. Accordingly, in the construction of the table all doubts have been resolved in favor of this position, with the result that in practice the mortality experience of every well-managed company is less than that indicated by the table upon which its premium rates are based. In like manner, as heretofore explained, it is morally certain that the actual interest earnings will be in excess of the rate assumed, so that in practice there will be a gain from both sources named, and our receipts will be in excess of the amount required to meet our obligations.

SOURCES OF GAIN

To the end that the comments following may be readily comprehended, it is suggested that the reader keep the Verification Table (pages 46 and 47) before him for constant reference.

SAVING IN MORTALITY

In our hypothetical company of 63,864 members, all of the age of fifty-six, we have made provision for 1,260 deaths the first year, that being the tabular mortality. As each member is insured for \$1,000, the expected death claims will amount to \$1,260,000. Let us assume now that the actual deaths number only 1,160, making actual death claims \$1,160,000, or \$100,000 less than was counted upon and *provided for* in the premiums collected. The actual saving in mortality, however, is not \$100,000; for at the end of the year, at the attained age of fifty-seven, we shall have 62,204 members living instead of 62,104. The 100 additional lives must be paid for ultimately, and in the valuation of its assets and liabilities, the company will be charged with a terminal reserve of \$29.90 for each of these lives, making an additional reserve liability of \$2,990. This sum being deducted from the \$100,000 of death claims saved, makes the actual saving in mortality \$97,010. In other words, the saving in mortality consists, not of the face amount of death claims saved, but of the amount at risk pertaining to those claims. In the case of our hypothetical company the amount at risk on each life during the first policy

year is \$970.10. (See page 67.) With one hundred fewer deaths than were expected, the saving in mortality will be $\$970.10 \times 100 = \$97,010$.

THE ACTUAL SAVING

The beginner is sometimes puzzled at this stage by a problem which suggests itself in the following form: Referring to the saving in mortality of \$97,010 in our first year, has this amount really been saved, or has its payment simply been deferred? After all, the one hundred lives are still with the company and will pass away within the limit of life, some very shortly, others after many years; and the policies represented by them must ultimately be paid. Instead of an actual saving of \$97,010 then, do we not in reality save merely the interest on the \$100,000 of death claims whose payment has been deferred?

You have seen by the Verification Table that for each of the 62,104 members living at the end of the first year at the attained age of fifty-seven, we hold a terminal reserve of \$29.90, and that these accumulated reserves plus the future net premiums to be received, will provide funds exactly sufficient for the payment of all existing policies as they mature. If this is true of 62,104 members, it will likewise be true of 62,204, or of 100,000, or of any other large number. We have therefore had an actual saving in mortality of \$97,010, and have accumulated an actual profit or gain of that amount, since for each of the 62,204 members of the age of fifty-seven now belonging to the company, we hold a reserve of \$29.90, and are to collect from each a net premium of \$47.760895

every year hereafter, even as in the case of the original number of 62,104.

To illustrate further: let us take the case of the twenty-one members living at the age of ninety-four. Assume that there will be seventeen deaths instead of eighteen, a saving of one. As the terminal reserve on one life is \$923.11, the amount at risk will be \$76.89, which will accordingly be the saving in mortality. The four lives now remaining will begin the next year at the attained age of 95, and, according to the table, none of these will live beyond the end of that year, or beyond the attained age of 96. The payment of the claim on the fourth life, therefore, is simply deferred for one year. Does it not seem, then, that the saving in mortality will be merely the interest on \$1,000 for one year, to wit: \$30, instead of the amount at risk, \$76.89?

Let us see how it works out. Taking age ninety-four, we have now four members living at the end of the year, at the attained age of ninety-five, instead of three, and we shall accordingly have a total reserve of \$3,692.45 (making due allowance for decimal correction), instead of \$2,769.34. ($\$2,769.34 + \$923.11 = \$3,692.45$). Modifying the Verification Table accordingly, the operations of the last year may be tabulated as follows:

Net Premium Income at age 95 (\$47.760895x4)	\$191.04
Add Terminal Reserve of preceding year....	3,692.45
Initial Reserve, age 95.....	\$3,883.49
Add one year's interest at three per cent.....	116.51
Terminal Reserve, attained age of 96.....	\$4,000.00

The result proves that the saving in mortality is measured by the amount at risk, and not by the interest earned on the face of deferred death claims.

WHEN SAVING IN MORTALITY IS GREATEST

Experience has shown that the saving in mortality will be greatest in the case of business most recently written, owing to the culling out of impaired lives by medical examination. For instance, the mortality in the first year of insurance is rarely so much as fifty per cent. of the tabular rate, and is much less than the normal for several years longer. The benefit derived from medical selection, however, is commonly assumed to be lost within about five years, and much the greater part of it undoubtedly does accrue within that period. This does not mean that a thousand lives, five years after medical examination, would average no better physically than a like number of new risks, accepted without any examination at all. Any company which might adopt the latter course would be quickly overwhelmed with impaired lives that would not ordinarily apply for insurance because conscious of their inability to pass an examination.

A MISLEADING RATIO

The low death rate in the years immediately succeeding medical examination is instrumental in effecting a large saving in mortality in the case of new companies, and of old companies writing a large new business. While this saving in mortality is largely offset by the increase in the expense account, owing to the relatively large cost of new business, it is also true that the new company, or the company writing a large new business will necessarily show a comparatively high expense ratio, owing to the

large outlay for commissions and other items of initial cost, but this increased expense may be more than offset by the increased saving in mortality. The facts cited simply indicate the inevitably misleading character of an expense ratio which fails to take into account compensating conditions.

Inasmuch as a low mortality is incidental to all new business and therefore to all new companies, whether assessment or "old line," the absurdity of citing it as something phenomenal, and as evidence of extraordinary care in selection of risks, is apparent. It is undoubtedly true that careful selection will go far toward increasing the saving in mortality; but it is likewise true that the low death rate of the new company is mainly attributable to the fact that it is new, its members, or a large proportion of them, being fresh from the medical examiner's hands.

In addition to saving in mortality and excess of interest earned, there may be gains from other sources, though in a less degree. The loading for expenses and contingencies may be in excess of the requirements, or there may be an apparent saving by reason of reserves released on lapsed and surrendered policies. The word "apparent" is used because such savings are, under modern conditions, rarely more than enough, even if enough, to defray the expense of replacing the risks with new lives.

LAPSES NOT A DESIRABLE SOURCE OF PROFIT.

If *all* life or endowment policies written were to lapse at the end of two years, the forfeited reserves might constitute an important source of profit; or if *all*

policies were certain to lapse at the end of three or four years and not sooner, there would doubtless be a profit from that source, notwithstanding a surrender value is allowed at the end of the third year. The amount that may be withdrawn at the earlier years is usually less than the full reserve, a part of the latter being retained by the company as a *Surrender Charge*. Although so much of the reserve as may be forfeited in the case of a lapsed or surrendered policy is technically termed a "gain" and necessarily appears as such in the company's annual statement, this supposed gain is largely or wholly offset by the fact that it is ordinarily the sound lives that lapse or withdraw. The man about to die, or whose health has become impaired, clings to his insurance. Thus lapses naturally tend to increase the normal proportion of invalids and impaired lives in a company, resulting in an increased mortality. This is certain to be the case when the number of withdrawals is excessive through loss of confidence in the company or dissatisfaction with the management. This tendency of sound lives to withdraw and of impaired lives to maintain their insurance in force, or to seek new or more insurance, merely because they *are* in impaired health, is termed *Selection Against the Company*, or *Adverse Selection*. On the other hand, some extended observations would indicate that when lapsing is normal—not unduly stimulated by special causes—the withdrawals as a class may be little or not at all better than the risks remaining. Nevertheless, the generally accepted theory is, that lapses tend to a deterioration of the business, and it is always a question of grave concern to the company whether the surrender charge exacted is sufficient to compensate for the adverse selection.

LAPSES AND TERMINATION BY EXPIRY

It should be noted here that some companies give an extended insurance surrender value at the end of the first year, or even at the end of the first quarter. If the premium is not paid and the policy is not surrendered for cash or paid-up value, the insurance is not entered on the books as lapsed, but becomes automatically a paid-up term policy good for a brief period, at the end of which, if not reinstated, it terminates by expiry. In some cases a small cash value is offered, even after the payment of but one quarterly premium. By this means the *apparent* number of lapses or withdrawals, most of which occur during or at the end of the first year, is very greatly diminished. The reader will perceive the absurdity of comparing the figures of official reports as to "lapsed and surrendered" policies, unless this class of terminations be included.

SLIGHT GAINS FROM SAVING IN MORTALITY AT THE OLDER AGES

Recent observations tend to show that improved sanitary conditions and the great advances made in modern medical science and surgery, have increased somewhat the average length of human life. The probable effect has been to prolong the lives of many who, under former conditions, would have succumbed in childhood or youth to the effects of disease or injury. In the case of insured lives doubtful risks are eliminated, but as the accepted lives grow older the benefits of medical selection gradually disappear, and we find the actual mortality approaching more nearly to the tabular. For

this reason it may be anticipated that the saving in mortality will be slight in the case of insurance that has been long in force. As a matter of fact and for another reason, the saving in mortality does steadily decrease with the age of the policies, even though the actual death rate of the company continues to be much below the normal. This is because the saving is measured by the amount at risk, and not by the face of the claim. To illustrate: referring to the table on page 67, showing the amount at risk in the case of an ordinary life policy issued at age fifty-six, assume the actual mortality for a series of years to be \$1,000 less than the tabular. The saving in mortality then will be \$970.10 in the first year at age fifty-six, \$562.75 at age seventy, \$323.58 at age eighty, and \$127.82 at age ninety.

SAVINGS VARY ACCORDING TO RESERVE BASIS

The savings or gains will vary according to the reserve basis, the gain from interest being greater in case of a three than of a three and a half or four per cent. reserve. To illustrate, for example, the gain from interest earned in excess of the assumed rate, suppose the rate actually earned to be 5 per cent. The gain in the case of a three per cent. reserve will, then, be two per cent., against one per cent., on a four per cent. basis. In the former case there is not only a larger percentage of gain, but it is a percentage of a larger sum, since a three per cent. reserve is larger than a four per cent. reserve.

On the other hand, inasmuch as the amount at risk is less in the case of a three per cent. reserve, the saving in mortality will likewise be less than on a four

per cent. basis. For example: at age fifty-six the three per cent. reserve at the end of the first year is \$29.90 and the amount at risk (saving in mortality in case of one death less than expected) \$970.10, while the four per cent. reserve is \$27.46, making the saving in mortality \$972.54. The difference, however, will not be great in comparison with gain from interest, for the variation in amount at risk will be but slight in the earlier years, when the accumulated reserves are small; while at the older ages, when the actual death rate approaches more nearly the tabular, and the saving in mortality is, for that reason, little or nothing, the reserves are large and the gain from interest more pronounced.

To illustrate this subject more fully, consider the case of one thousand persons all of the age fifty-six insured for \$1,000 each on the ordinary life plan. The three per cent. reserve at the end of the first year would be \$29.90 on each policy, and the amount at risk \$970.10. The expected number of deaths in these one thousand lives according to the table would be 19.88, and the total expected death claims \$19,880. (See "Death Rate per 1,000," mortality table, page 13). Assuming the actual death rate in the first year to be fifty per cent. of the tabular, the actual number of deaths would be 9.94 and the actual mortality \$9,940. That is, the number of deaths would be 9.94 less than expected, and as the amount at risk (saving in mortality) in each case is \$970.10, the total saving in mortality would be \$970.10 multiplied by 9.94, or \$9,642.79.

On a four per cent. basis in the same company the reserve on a single policy would be \$27.46 and the

amount at risk \$972.54. The total saving in mortality, therefore, would be \$972.54 multiplied by 9.94, or \$9,667.05. That is, in the case of these one thousand policies the total saving in mortality on a four per cent. basis would be just \$24.26 more than in the case of a three per cent. reserve.

Let us now consider the gain from interest in the same case. The three per cent. initial reserve on a single policy in its first year being \$47.76 (net premium), the total reserve on one thousand policies at the beginning of the first year would be \$47,760. Assuming that the actual interest earned is five per cent., the total gain from interest during the year would be two per cent. computed on a total initial reserve of \$47,760, or \$955.20. The total four per cent. initial reserve would be \$45,000, and the gain from interest would be one per cent. of that amount, or \$450.00, being \$505.20 less than in the case of the three per cent. reserve.

Let us see now how it would be at the end of the year in which the insured reaches the age of seventy years. Of 1,000 persons living at fifty-six, 609 would still be living at seventy according to the table, and of these the expected number of deaths within a year would be 87.76. On policies more than five years old, it is generally assumed that the actual death rate will be approximately the same as the tabular. In that case there would be virtually no saving in mortality at all; but let us assume, for the sake of illustration, that the actual number of deaths in this case will be two less than the tabular. As the three per cent. terminal reserve on such a policy for the fifteenth year would be \$487.25,

the amount at risk would be \$562.75. The saving in mortality, therefore, would be just \$562.75 for each of the two risks saved, or a total of \$1,125.50. On the other hand, the four per cent. terminal reserve would be \$416.39, the amount at risk \$583.61, and the saving in mortality also \$583.61 for each life saved, a total of \$1,167.22, or \$41.72 more than on a three per cent. basis.

Again, the three per cent. initial reserve in this case being the terminal reserve of the previous year (\$410.62, Verification Table, pages 46 and 47), plus the net premium (\$47.76), or a total of \$458.38 on a single policy, the total reserve on 609 policies would be \$279,153.42, and a gain from interest of two per cent. would be \$5,583.07. On the other hand, the four per cent. initial reserve being \$435.17 on a single policy, the total reserve on 609 policies would be \$265,018.53, and a gain from interest of one per cent. would be \$2,650.19. The saving in mortality in the case of the 4 per cent. policy is the greater by \$41.72, but the gain from interest in the case of the 3 per cent. policy is the greater by \$2,932.88.

METHODS OF DISTRIBUTION.

The so-called "profits" in life insurance—saving in loading, gain from interest, etc.,—are in reality savings, not profits. Having assumed that our funds would earn a certain rate of interest and that our mortality would follow the table, the net premium was fixed accordingly. Subsequent experience having developed a lower mortality rate and a higher rate of interest than were assumed, the actual or net cost of the insurance was found to be less than had been anticipated.

The difference represents an overcharge, which, being returned to the policy-holder, is so much saved in the cost of his policy instead of a profit earned on his investment. Such savings are usually referred to as *Surplus*, being funds received by the company in excess of what is necessary to enable it to fulfill its contracts. In a stock company, where such savings go to the stockholders instead of to the policy-holders, they are, as to the former, genuine profits.

In a mutual company, such as The Mutual Life, the surplus or savings are all returned to the policy-holder, the amount apportioned to each policy being termed, somewhat ineptly, a *Dividend*. Dividends may be apportioned to policy-holders yearly or at the end of a stated period of years, as five, ten, fifteen, twenty, etc. The former plan is known as the *Yearly Dividend* or *Annual Dividend* system, while by the latter plan the apportionment is made after different methods variously designated as *Tontine*, *Semi-Tontine*, *Deferred Distribution*, etc. In most companies the policy-holder himself elects, at the time of making application, by what system his share of the gains or savings shall be apportioned, whether yearly or at the end of a stipulated period. Since December 31, 1906, all surplus in the case of new issues has been distributed by The Mutual Life yearly.

SEMI-TONTINE PLAN

Under the *Semi-Tontine* method of distribution the policy-holders are divided into classes, commonly according to date of entry and length of distribution period selected. For example: the members joining in a

specified year, say 1900, and selecting a particular distribution period, say fifteen years, constitute a class to themselves. All gains and savings accruing to the policies of this class during the fifteen years are set aside and accumulated to their credit. The beneficiaries of the members who die during the period receive payment of the face value of their policies, and lapsing or withdrawing members receive such surrender values as may have been stipulated in the contract or required by law; but in either case, the interest of such members in the gains or savings that may have accrued up to the date of death or withdrawal, is forfeited to the remaining members of the class, among whom they are accordingly distributed at the end of the stipulated period. Observe that *Semi-Tontine* distribution implies the accumulation of gains or savings for the benefit of a particular class, and involves the forfeiture of the gains of those members of the class, who die or withdraw during the period, for the benefit of those who live or persist to the end.

THE TONTINE METHOD

Tontine distribution differs from semi-tontine in that not only the gains of the lapsing members are forfeited, but their reserves as well. The beneficiaries of those who die receive payment of the face value of their policies, but those who lapse or withdraw before the end of the tontine period receive nothing, no surrender values being allowed. This form of insurance is no longer written in this country, and would in fact be illegal in most states under the non-forfeiture laws.

THE MUTUAL LIFE METHOD

The method, which is followed by The Mutual Life in determining the dividends upon its policies issued in former years and having a distribution period longer than one year, differs essentially from the methods just mentioned. The Mutual Life's method is to base these long term distribution dividends upon the annual dividends which have been declared each year during the distribution period in the case of otherwise similar policies, which were entitled by contract to receive dividends annually. The method of calculation is as follows:

(1) The annual dividends which the policy would have received had it been entitled by contract to receive dividends annually are taken: (2) these annual dividends are accumulated at compound interest to the end of the distribution period: (3) the amount of these accumulated annual dividends is increased by a percentage as compensation for the risk run of losing surplus by death, discontinuance, or otherwise. In the case of fifteen and twenty-year distribution policies issued on the 1899 form, which guarantee surrender values at the end of the distribution periods greater than the reserves on similar annual dividend policies, the difference between such surrender values and such reserves is deducted from the accumulated amount above described.

As is evident, this method places the holders of annual dividend policies, and the holders of deferred distribution policies having different distribution periods, on a perfectly equitable basis as compared with one another, as well as with those having policies with the same distribution period.

THE CONTRIBUTION PLAN

The *Contribution Plan* for the apportionment of gains or savings in life insurance was introduced in 1863 by The Mutual Life Insurance Company of New York, having been devised by its then Actuary, Mr. Sheppard Homans, and his assistant, Mr. David Parks Fackler. It has since been adopted by American companies in original or modified form with practical unanimity, and by some companies abroad. For annual dividends this method in its original form consists in crediting the individual policy with the reserve pertaining thereto at the end of the previous year, and with the annual premium paid at the beginning of the current year, less an expense charge, adding interest at such rate as the circumstances permit. Against the sum so found are charged the cost of insurance (which may or may not be assessed according to the standard mortality table), and the reserve required at the end of the current year, the balance being that policy's "contribution to surplus," or its annual dividend.

Prior to the introduction of the contribution plan by The Mutual Life, dividends were apportioned in most companies by the *Percentage Method*, the same percentage of the premium being returned yearly or at the end of five-year periods on all policies alike, regardless of age or form of contract and often without reference to the length of time the latter had been in force. Methods more or less similar to that outlined were employed by other companies.

NON-PARTICIPATING INSURANCE

Gains and savings in life insurance are not always apportioned to the policies from whose premiums they

were derived. In some cases, in consideration of the payment of a smaller gross premium, it is agreed that the policy-holder shall receive no part of the accruing surplus—that is, he is to receive no dividends at any time. The policy in such case is said to be *Non-Participating*, since it is not entitled to participate in distributions of surplus. On the other hand, policies which are entitled to dividends are termed *Participating* contracts. The term *Stock Rate* is sometimes used as synonymous with non-participating.

Under the New York law, no home company can write both participating and non-participating contracts. If a mutual company, it can obviously write only the former. If a stock or mixed company, it must choose which form of policy it will write, and can then issue no other, either at home or abroad. Outside companies may write only one form within the state, but may issue either form elsewhere.

Similar participating and non-participating policies having the same reserve basis, whether issued by the same or by different companies, necessarily have the same net premium and the same reserve values. The difference in gross rates is due merely to a difference in loading. The latter is rarely, if ever, sufficient in the case of a non-participating policy to provide for necessary expenses, the purpose being to make up the deficit from the surplus accruing from other sources—saving in mortality, gain from interest, etc. This form of insurance is supposed to be issued at as nearly net cost as practicable, after providing for dividends to stockholders.

LIFE INSURANCE AT ACTUAL COST

If it were certain that the future death rate would correspond precisely with the mortality table, and if the rate of interest to be earned in the future could be determined in advance with absolute accuracy, it would then be possible to determine with certainty the exact net premium which it would be necessary to charge in order to furnish life insurance at actual cost. Such certainty, however, is impossible. Omniscience alone can say in advance what the actual cost of life insurance in the future will be. If the actuary were to undertake to name a figure that would precisely meet the case, he would inevitably name a sum either too large or too small. The latter alternative is not to be contemplated for a moment. To be on the safe side, therefore, it is essential to fix the premium at a figure which, we are morally certain, will prove to be larger than actual cost, and the margin over cost must, beyond a peradventure, be a *sufficient* margin. If that margin be too small, unforeseen contingencies may wipe it out and involve the company in insolvency and ruin. A slight margin may be safe enough if, by good fortune, all goes well. A driver may urge his team within an inch of the precipice and not go over the brink, but the prudent driver will keep further back.

In other words, the life insurance premium, even the non-participating premium, *must* be larger than actual cost. That is a condition which is universally conceded to be essential. In fact, every advocate of non-participating insurance will stoutly maintain that

there is an ample margin or overcharge in non-participating rates. To admit the contrary would be to concede that those rates, under adverse conditions, might prove too low and thus involve the company in ruin.

WHAT BECOMES OF THE OVER-CHARGE?

Although the actual cost of life insurance cannot be determined in advance, it can be computed at the end of each year when the books are balanced. The mutual company—that is, a company writing participating insurance—will then return the over-charge to the policy-holder in the form of a so-called dividend. Thus from year to year the insured does, *by the participating plan*, obtain his insurance at actual cost. In the case of the stock company which writes only non-participating policies, the over-charge, or margin over actual cost, goes to the stockholders. Nothing is returned to the policy-holder in any event. The cost to him is absolutely fixed. He knows in advance “just what he is to pay,” and he knows, too, that he will get nothing back.

Let us not complicate this question by discussing the merits of different companies, or the varying conditions under which they operate. To decide whether the participating or non-participating system is correct, we must assume in advance that the two companies are managed with equal honesty and efficiency, and that attendant conditions are substantially the same. It then follows, as certainly as two and two are four, that only in participating insurance is protection at actual cost a possibility.

The advocate of the non-participating plan will claim that, while *his* premium does include an over-charge

as a provision for stockholders' profits and as a margin of safety, the *participating* premium carries a larger margin than is necessary. This may sometimes be true, but inasmuch as that difficulty is adjusted at the end of each year, when the books are balanced and the overcharge returned, the policy-holder will be content to have it so, since the larger margin affords greater assurance of safety. No one can tell what the exigencies of the future may develop. Adverse legislation, excessive taxation, other unforeseen contingencies, such as would wipe out the margin in the non-participating premium and endanger the solvency of the company, would result only in a diminution of dividends in case of a mutual company with its larger participating premiums. Safety is of more importance in life insurance than all else. It is better to keep away from the brink of the precipice, even at some temporary inconvenience.

Within the last ten years, many new companies have been organized. A number of these institutions have very limited resources—are in fact still in the experimental stage—and some are directed by men who, however successful they may have been as insurance agents, have had little or no experience in company management. A large number of these organizations write participating insurance with a sufficient margin in their premiums to enable them to survive the mistakes commonly incidental to the inexperience and over-confidence of youth. Others propose to write non-participating insurance exclusively, thereby taking chances that companies long established and of great strength might well hesitate to assume. The company that essays to write

this class of business, not having the reserve strength afforded by the redundant premiums of participating insurance, should at least possess large capital as a guaranty against possible disaster from the use of rates that may, under adverse conditions, prove insufficient.

CHAPTER X

NATURAL PREMIUM INSURANCE

WE have seen that the net annual premium of an ordinary life policy at age fifty-six based on the American Experience Table of Mortality and three per cent. interest, is \$47.76, or more accurately, \$47.760895. This is the net amount mathematically necessary to be paid yearly during life by each of the 63,364 members of our hypothetical company, to make possible the payment of \$1,000 for each death until the last three members pass away at age ninety-six. By reference to the Verification Table, pages 46 and 47, it will be seen that this amount paid by each of the 63,364 members, yields in the first year the sum of \$3,026,321.35, while the death claims to be met in that year are only \$1,260,000. We have therefore collected much more than was necessary for the payment of current claims, but it has been proved in the Verification Table that the excess collected in the earlier years will all be needed at a later period, when the members are older and the death rate higher. It is obvious, therefore, that if we were to collect only enough in any year to pay the death claims of that year, we should have to charge a continually increasing premium in subsequent years.

To illustrate: Of the 63,364 persons at age fifty-six comprising our hypothetical company, 1,260, according to the Mortality Table, will be dead at the end of the year, requiring a payment at that time of \$1,260,000. To provide for this amount we shall have to collect from the members at the beginning of the year a

premium sufficient to amount in the aggregate to the present worth of that sum; that is, a fund which at three per cent. interest will amount to \$1,260,000 at the end of the year. The present worth of \$1.00 due in one year is \$0.97087379. Hence the present worth of \$1,260,000 is \$1,223,300.98. ($\$0.97087379 \times 1,260,000 = \$1,223,300.98$). Dividing this amount by 63,364, the number of members living at the beginning of the year, we get \$19.31. That is to say, if each member at the beginning of the year will pay a net premium of \$19.31, or, more accurately, \$19.3059305, we shall have a total insurance fund of \$1,223,300.98, which at three per cent. interest will amount to \$1,260,000 at the end of the year, or just enough for the payment of the accrued claims.

At the beginning of the second year we have 62,104 members still living of whom 1,325 will be dead at the end of year, requiring the payment at that time of \$1,325,000. The present worth of this sum due in one year is \$1,286,407.77, which is therefore the amount to be collected at the beginning of the year. Dividing by 62,104 we get \$20.71, which is the net premium to be paid by each member in the second year. By like process we find that the net premium for the third year at age fifty-eight is \$22.27.

The premium thus determined is called the *Natural Premium* as distinguished from the *Level Premium*, with which we have heretofore had to do, the latter being a fixed charge that can never be increased, and which is sufficient both for current and future cost. The *Natural Premium* represents the actual current cost and increases each year as the insured advances in age,

and in proportion to the probability of his dying. This form of insurance as in use with the fraternal orders is sometimes called the *Step-Rate* plan, and is the same as yearly renewable term insurance heretofore described.

The natural premium does not increase rapidly at the younger ages, but advances at a vastly greater rate as the insured approaches the limit of life, as will be seen by the following table.

Age	Natural Prem.	Age	Natural Prem.
35.....	\$8.69	60.....	\$25.92
36.....	8.82	70.....	60.19
37.....	8.97	80.....	140.26
40.....	9.51	90.....	441.81
50.....	13.38	95.....	970.87

THE COST OF NEW BUSINESS

One of the principal items of expense with a life insurance company is the cost of new business. Ordinarily, the agent who places a policy receives a *Commission* for his services, which may be a percentage of the first premium only, termed a *Brokerage*, or it may include a smaller percentage of a stated number of subsequent premiums, termed a *Renewal Commission*. Although the renewal commission is a percentage of subsequent premiums, a part of it, at least, should be included in the cost of new business. This is clear from the fact that the agent is induced to accept a smaller brokerage, or percentage of the first premium, by the offer of a substantial renewal. Moreover, it is often the case that the agent receiving the renewal commission has nothing whatever to do with the collection of subsequent premiums, the contract even providing in some cases for

the continuance of renewals after the death of the agent, or after the termination of his connection with the company.

There are other matters of expense pertaining partly to the cost of new insurance, partly to the care of old business, which it would be equally impracticable to apportion with entire accuracy between the two items. However, the New York law, for the purpose of placing a limit upon expenses, designates the items which shall be considered as constituting the cost of new business, but without assuming scientific accuracy.

THE PRELIMINARY TERM SYSTEM.

The statement may be safely made that the ordinary loading of a life insurance premium is never sufficient in the first year to meet the expenses incident to securing the business. To illustrate: If the gross premium of an ordinary life policy at age fifty-six, American Experience Table and three per cent. interest, is \$68.68, we find, by deducting the net premium of \$47.76, that the loading is \$15.92. The principal items of expense the first year will be the agent's commission, say forty per cent., or \$25.47, and the medical examiner's fee, \$5.00, making for these two items alone \$30.47, or nearly double the amount of the loading earned by the new policy. Inasmuch as the agent, when settling for premiums collected, usually retains his commission, remitting only the net amount, the erroneous impression has gained acceptance that the commission is paid from the first premium. As a matter of fact, the commission and other

cost of new business are paid from the entire loadings of the company, earned on all policies outstanding, or from other funds available for expenses. The commission could not be paid from the first premium, for the net premium, or reserve, must not be trenched upon, as would occur in that case. Neither is the required amount "borrowed" from the "surplus belonging to old policy-holders," as so often stated. The loadings of all policies in force are for expenses, including the cost of new business.

In the case of young companies, however, which have but little insurance in force and hence small receipts from loading, the policy sometimes provides that the contract shall be valued in the first year as term insurance, the regular life insurance policy beginning one year later. Thus the entire first premium, less only the charge for the actual mortality of the year, is available as a loading for meeting the cost of new business. This method is variously designated as the *Preliminary Term*, or *First Year Term*, system, and has been adopted by most companies organized in recent years. In the case of a preliminary term ordinary life policy at age fifty-six, the net premium in the first year would be merely the natural premium, or yearly term rate, that is, \$19.31, as given above (page 117). The practice of preliminary term companies is, however, to charge the same *gross* premium in the first as in subsequent years. If the gross premium is \$63.68, we shall have, after deducting the net premium of \$19.31, a loading the first year of \$44.37, or about seventy per cent. Deducting \$5.00 for medical examination, there remains a balance of \$39.37, or nearly sixty-two per cent., for commissions and other expenses.

In the valuation of such a contract the company is not, of course, charged with any reserve at the end of the first year, but during the second and subsequent years the net premium required will be that of an ordinary life corresponding to age fifty-seven, the attained age of the insured when the regular life policy begins. In this case, then, the net premium in the second and subsequent years would be \$50.18 instead of \$47.76 (the net premium at age 56), and if this amount be deducted from the gross premium of \$63.68, the balance of \$13.55 will be the permanent loading instead of \$15.92. Thus it will be seen that by this system the loading is greatly increased in the first year, but is materially less than the regular loading in subsequent years. There will be no reserve at the end of the first year, and the reserve of the second policy-year will be the same as the first year reserve of a regular ordinary life policy issued at age fifty-seven. In fact, from the beginning of the second year the policy will be valued as an ordinary life issued at age fifty-seven, or one year later than its actual date, as stated above. It follows that the accumulated reserve of an ordinary life policy issued on the preliminary term plan will at all stages be less than it would have been had it been issued at the same age on the regular ordinary life plan, because always one year behind in the process of accumulation. This difference will continue until age ninety-six, when the reserve in either case becomes equal to the face of the policy. It will be appreciated that smaller reserves mean smaller cash values, and also that smaller loadings mean smaller dividends.

We have heretofore defined the terms "level premium" and "net valuation." Under the preliminary

term system the gross premium may be level from date of issue of policy, but the net premium is not so. For example, in the case just illustrated, the net premium in the first year is \$19.31 and in subsequent years \$50.13, although the gross premium is \$68.68 for every year. On the other hand, we have seen that the net premium of the equivalent ordinary life policy on the regular legal reserve plan is \$47.76, the same fixed amount for every year including the first. In that case we have a *Level Net Premium* as distinguished from the net premium of the preliminary term plan, which is not level.

In the case of a "limited premium" policy the preliminary term plan varies somewhat from that illustrated. Let us consider its application, for example, to a fifteen payment life. The net three per cent. premium of the regular policy at age fifty-six would be \$60.17. If the gross premium is \$78.16, the yearly loading will be \$17.99. On a preliminary term basis, the equivalent contract would consist of a combined one year term policy and a fourteen payment life, the latter beginning at age fifty-seven. The net premium for one year's term insurance would be the same as before, \$19.31. Deducting this amount from the gross premium of \$78.16, we obtain a first year loading of \$58.85. The three per cent. net premium of the fourteen payment life at age fifty-seven would be \$64.55, which leaves a yearly loading of \$13.61, instead of \$17.99, for the remaining fourteen years. As in the case of the preliminary term ordinary life, there will be no reserve at the end of the first year. At the end of the second policy year the reserve will be \$46.14. This is larger than the first year reserve of the

regular policy, but much smaller than the reserve of the latter at the end of the second policy year, it being then \$86.72. The preliminary term reserve at the end of each subsequent policy year approaches more and more nearly to the corresponding reserve of the regular fifteen payment life until the end of the fifteenth year when, at the attained age of seventy-one, both reserves are necessarily the same, since both policies are now fully paid up. In other words, on the regular fifteen payment life the reserve of a fully paid policy is accumulated in fifteen years, while on the preliminary term fifteen payment life the same reserve is accumulated during the last fourteen years.

The preliminary term system, as applied to an ordinary life policy, is not an unreasonable method of providing for the cost of new business in the case of a young company, notwithstanding the apparent injustice of charging a premium of \$63.68 for term insurance during a single year, the net natural cost of which is \$19.31. Indeed, only by the use of some such expedient would it be possible for a new company to establish itself at all on the mutual plan, since, being in receipt of little or nothing from loadings on old business and having no accumulated surplus, it would be unable to meet the necessary cost of new insurance and provide at the same time for the required legal reserve of the first year. Only on the stock plan, with the stockholders personally advancing extra funds for the purchase of new business, could a new company comply with the requirement to put up the full level net premium reserves on its policies beginning with the year of issue. The adoption of the

preliminary term plan by an *old* company, however, is commonly regarded as a confession of weakness or of an extravagant management, since it is a virtual admission that the company is unable to keep its expenses within its aggregate receipts from loadings on all business, and that it dare not trench upon its limited surplus.

If the application of the preliminary term plan to the ordinary life policy is defensible, it nevertheless becomes decidedly objectionable when applied without modification to limited payment and endowment policies, as illustrated in the following table showing the loadings of the first year:

Policy, Age 56	Gross Premium	Net Natural Cost	Loading
Ordinary Life.....	\$63.68	\$19.31	\$44.37
Fifteen Payment Life....	78.16	19.31	58.85
Ten Payment Life.....	99.83	19.31	80.02
Twenty Year Endowment.	72.66	19.31	53.35
Ten Year Endowment....	121.06	19.31	101.75

The grotesque absurdity of such loadings, sufficiently condemns the *Full Preliminary Term* system, by which is meant the application of preliminary term without modification to all forms of policies.

MODIFIED PRELIMINARY TERM

In 1897 there was introduced a modification of the preliminary term plan, which consisted in limiting the loading of the first year on all limited payment and

endowment forms to the amount available, on a preliminary term basis, on the ordinary life policy. For example, referring to the table above, while the gross premiums would vary on the different forms as indicated, the loading could in no case exceed that of the ordinary life policy, to wit: \$44.37. From the balance of the premium on limited payment and endowment forms the company would put up a reserve in the first year, thus reducing the net premium and increasing the loadings of subsequent years. The tendency of this plan would be to encourage the sale of ordinary life policies rather than limited payment and endowment contracts. Several modifications of "modified preliminary term" have been legalized in different states.

SELECT AND ULTIMATE VALUATION.

This method of computing reserves was devised as a substitute for modified preliminary term. To a correct understanding of the system a knowledge of the several classes of mortality tables is necessary.

Assume, for illustration, that we wish to ascertain how many of 100,000 persons, all thirty years of age, will die within one year. If to that end we note the history for twelve months of 100,000 persons of the age stated, who have just passed a rigid medical examination for life insurance, we shall find a much smaller number dying than in 100,000 of the same age who were examined five years ago, at age twenty-five. If we note the history of both classes during the succeeding year, we shall find a larger percentage of deaths in each instance than in the first year, and, as before, a smaller percentage of deaths

in the first than in the second class, but the death rates of the two classes will now be nearer together than in the first year. In the third year, while the death rate of each class will again be higher than formerly, the difference between the two rates will again be less than in the second year. With each added year the difference in death rates of the two classes will diminish, until ultimately, after the benefit of medical selection has worn off, the two death rates will be theoretically the same. It is commonly assumed that this stage will be reached in five years.

Lives which have just been selected by a medical examination are called *Select Lives*, and a mortality table based on the subsequent history of such lives is called a *Select Table*.

As it is assumed that the effects of medical selection *ultimately* disappear, say in about five years, a mortality table based on the history of lives insured five or more years before is called an *Ultimate Table*.

A mortality table based on the history of lives insured, some within the year, others within two or three or ten years or more, is called a *Mixed Table*.

The American Experience Table of Mortality, which is in general use in the United States, is an "ultimate table," its compilation having been based upon the subsequent history of lives insured for five years or more. The rate of mortality indicated by this table, therefore, is materially greater in the first five years, at least, than that pertaining to select lives at corresponding ages. As a basis for establishing a minimum standard of valuation and for fixing a limitation of

expenses in securing new business, the New York Law assumes that the mortality of select lives in the first policy-year immediately following medical examination will be fifty per cent. of the tabular mortality of the American Experience Table; in the second year, sixty-five per cent.; in the third year, seventy-five per cent.; in the fourth year, eighty-five per cent.; in the fifth year, ninety-five per cent.; and in the sixth and subsequent years, one hundred per cent. On this basis smaller terminal reserves will be required during the first four years than by the American Experience Table though they will be the same from the fifth year on, as illustrated in the following comparison of terminal reserves computed by the two methods on an ordinary life policy issued at age fifty-six.

End of Year	Terminal Reserves	
	American Ex- perience Table	Select and Ultimate
First	\$29.90	\$14.41
Second	59.94	50.84
Third	90.06	85.87
Fourth	120.21	119.13
Fifth	150.33	150.33
Sixth	180.36	180.36

This is the system of *Select and Ultimate Valuation* authorized by the laws of New York as a minimum standard. In this standard the new company, which might find it impracticable to put up the level net premium reserves in the first and immediately succeeding years, has a substantial measure of relief. The company collects during the first four years, as well as thereafter, the full gross premium. The margin in the first year's

premium by reason of the smaller reserve required—the full reserve being made up in subsequent years by the saving in mortality—is available for other purposes and may be anticipated and expended in securing new business.

CHAPTER XI.

SUNDRY TOPICS

IN the foregoing pages we have discussed in their logical order such technical subjects and defined such terms as seemed important for the life insurance agent to understand. The items treated of may well be supplemented by a few others, heretofore omitted because not necessary to the proper comprehension of the current text.

INSURABLE INTEREST

The question of insurable interest is frequently an important one. Since, however, the law on this subject varies so much in the different states, it is impossible to make a satisfactory general statement of the law relating to it. In some of the states (for instance, New York), a very liberal view obtains, and it is held that where the person whose life is insured makes application for the insurance he can name any person as the beneficiary, and that in such a case it is not necessary to inquire whether the proposed beneficiary has an insurable interest in the life of the insured or not. In other states it is necessary in all cases to inquire whether the proposed beneficiary has such a pecuniary interest in the life of the insured as would permit him, the beneficiary, to apply for and obtain insurance upon the life of the insured. In the case of certain near relationships such as husband and wife, parent and child, an insurable interest is presumed. In some states, however, an adult child is held

not to have an insurable interest in the life of his parent unless the child is actually dependent upon the parent for his support.

It is quite generally held that a creditor has an insurable interest in the life of his debtor to the extent of his debt; also that one partner has an insurable interest in the life of another partner.

The question of insurable interest also arises in connection with assignments of life insurance policies. Some states, including New York, take the liberal view that an assignee need have no insurable interest in the life of the insured unless it appears that the assignment is made for the express purpose of speculating on the life of the insured. In other states the assignee is required to have an actual pecuniary interest in the life of the insured; that is, the assignee must sustain such relation to the insured that the death of the latter would cause a pecuniary loss to the assignee.

STANDARD POLICIES

All policies issued in New York State by New companies must include the "standard provisions" prescribed by the New York Laws. New forms of policies may be issued when approved by the insurance department after a public hearing open to all persons interested. The approved forms then become "standard" and may be written by any company.

ANNUITIES

In addition to the life annuity (page 20) and the temporary annuity (page 31), several other forms require our attention.

A *Survivorship Annuity* is one which becomes payable to a designated person, beginning at the death of the insured. This contract, as written by The Mutual Life, enables the insured to provide a life income for a designated beneficiary, an aged parent for example, at a much smaller outlay than by any other form.

A *Deferred Annuity* is one, the payments of which do not begin until a specified future date, or the occurrence of a designated future event. This contract enables the insured, who may have no one dependent upon him, to provide an income for his own old age at a smaller outlay than by any other method.

When an annuity is to be paid for a specified number of years, no more and no less, as ten or twenty, whether the annuitant continues to live or not, and regardless of any other contingencies, we have an *Annuity Certain*. If the proceeds of a policy, for instance, are to be paid in a fixed number of yearly instalments of a stated amount each, such instalments constitute an annuity certain. The present worth of such instalments, that is, the sum in hand which, at a given rate of interest, will produce instalments of the stated number and amount, is termed the *Commuted Value* thereof, and is, of course, also the value of the annuity in that case.

A *Perpetual Annuity* is one which is to be paid continuously, without limit of duration. Such annuities are, perhaps, unknown in this country, but are common in England. Corporation shares or bonds which are never to be redeemed, but which bear a specified rate of interest in perpetuity, come within this designation, the interest payments constituting a perpetual annuity. The British consol is an example of a perpetual annuity.

Neither the annuity certain nor the perpetual annuity involves any question of *Life Contingency*; that is to say, they are not based upon the probability of the continuance or termination of a designated life, and life insurance companies accordingly do not issue such contracts, save annuities certain as supplementary to insurance policies.

All New York standard policies of the ordinary life, limited payment life, term or endowment forms, may, at the election of the insured, (or at the election of the beneficiary if the insured has not acted in his lifetime), be made payable either in a specified number of equal yearly instalments, as an annuity certain, or as a *Continuous Instalment Policy*. The latter plan involves two forms of annuity, to wit: An annuity certain and a deferred survivorship annuity. To illustrate: Upon the death of the insured, an annuity contract will be issued providing, first: for the payment of annual instalments of an amount stated in the policy for twenty years certain, and second: for the continuation to the beneficiary of this annuity as long as she may live beyond the twenty years certain. When this form of settlement is applied to policies which by their terms are payable in a single sum, the amount of each instalment, or the annuity, depends upon the age of the beneficiary when the policy becomes payable. Any policy on the books of the Company, which is payable in a single sum of not less than \$1,000, may be settled in this manner, no matter how long ago issued, unless there are legal difficulties in the way. The regular continuous instalment policy, in its original form, provides by its terms for payment to a

designated beneficiary in yearly or monthly instalments. It differs from the mode of settlement first described in that each instalment is for a specified sum fixed at time of issue, the unit being \$50 yearly or \$10 monthly. The amount of the premium in this form is determined according to the age of both the insured and the beneficiary at date of issue. The continuous instalment contract is the ideal policy for the average family, providing, as it does, without danger of loss and without care of investment, an absolute income for a period of twenty years, whether the beneficiary lives so long or not, within which time the youngest child becomes self-supporting, and provides further for a continuance of the income during the lifetime of the beneficiary, if the latter survives the period named. The policy is now written by most companies under one name or another, but, in its original form, was devised in 1892 by Emory McClintock, then and for many years the renowned actuary of The Mutual Life Insurance Company of New York, and was introduced by that Company in its centennial year, 1893.

Within the last three or four years, numerous assessment companies have been organized to write a somewhat similar contract, sometimes with the additional provision that the annuity in case of a widow shall terminate upon the remarriage of the latter. Their rates, not being scientifically computed, are absurdly inadequate; the annuity payments are in all cases for the same amount per \$1,000.00 of insurance, regardless of the attained or previous age of the annuitant; and the contract does not contemplate the accumulation of a mathematical reserve. Furthermore, the contingency of marriage, like that of lapse, cannot well be considered in the computation of the premium. The law of probabilities cannot be applied satisfactorily to an event which, like that of lapse

or marriage, is largely or wholly within the control of the party most concerned. It is a different question from the application of the law to events which, like death, sickness or accident, are wholly fortuitous.

A *Contingent Annuity* is one which is to terminate on the happening of a stated future event, as the death of a designated person other than the annuitant, the marriage of the annuitant, the inheritance of an estate, etc. The specified event may be one which is bound to occur, as in the first-mentioned case, or one which may never take place, as in the last instance. It is possible, therefore, that a contingent annuity may prove to be perpetual, as it might, for instance, when payable during the life of the annuitant and thereafter to his next of kin. The extinction of his line would terminate the annuity, but this event may never occur. The contingent annuity is not written by The Mutual Life, nor, probably, by many American legal reserve companies, if any.

A *Joint Annuity* is one in which two or more lives participate and which is to terminate upon the death of any one of the lives concerned.

The *Joint and Survivor Annuity*, also called *Annuity on the Last Survivor*, is to be paid so long as any one of two or more designated persons continues to live.

NON-FORFEITURE.

A *Non-Forfeitable* policy is one which, by its terms, provides for a definite surrender value, accruing after a stated number of premiums have been paid. It has been the practice of most companies from an early date to allow an equitable paid-up or cash surrender value

after the expiration of a reasonable time, but a policy is not strictly non-forfeitable unless a provision for a definite and automatic paid-up, cash or extended insurance surrender value is incorporated in the contract.

INCONTESTABILITY

The policies of most companies provide that, during a stated number of years from date of issue, the insured shall not engage in certain extra-hazardous occupations, the policy to be void in case of death resulting from a violation of these conditions, or in case of suicide within a stated period. The purpose of such restrictions is the prevention of fraud by repelling or excluding applicants who are seeking insurance for the very purpose of defrauding the company through suicide, or for the very reason that they contemplate engaging in some extra-hazardous occupation, etc. After the expiration of the limit named, such restrictions become inoperative, the presumption then being that the policy was originally taken out in good faith. Thereafter the contract usually becomes *by its terms* incontestable for any cause, the premiums having been duly paid. The mere elimination of restrictions, however, does not render a policy incontestable, an express provision to that effect being necessary. Some policies are wholly free from restrictions from date, yet not incontestable by their terms until after the expiration of a stated period. Others are incontestable from date of issue, while still others are never incontestable, even after stated restrictions have become inoperative. The two forms of contract just mentioned are now very rare.

EFFECT OF FRAUD

The question has been raised as to whether under the rule of law that "fraud vitiates any contract," an absolutely incontestable policy can be written. It has been held in Kentucky that a policy, by its terms "incontestable from date," may be cancelled for fraud, while in Rhode Island a policy, purporting to be incontestable after two years from date of issue, was held to be strictly so. The company having reserved a stated period within which the contract should be contestable, it would be presumed that the period was a reasonable one and, accordingly, the fraud must be discovered and acted upon within that time.

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